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EDITORIAL NOTES.

Toluene and the Value of a Catalyst.

THE technical officials of gas undertakings are helping the Government to the best of their ability and opportunities in providing toluene for the manufacture of high explosives. But, at the same time, the natural desire exists that the means of doing this should have the minimum adverse effect upon the heating quality of the gas, and in the promotion of naphthalene troubles. There is not much difficulty in these connections where high-class coals are carbonized, even at high temperatures; but where second-grade coals are used, the matter assumes a somewhat different complexion. From them, owing to their high oxygen and sulphur content, with high temperature carbonization, the coke and tar are both of inferior quality. Now when a process is introduced—only demanding a comparatively trifling initial and working cost—which claims to increase the quantity and quality of the gas, enlarge the volume of the hydrocarbons in the gas and tar, materially increase the toluene content, allow the recovery of an additional quantity of the toluene by tar washing without harming the calorific value of the gas, while leaving in the latter a sufficient quantity of hydrocarbons to prevent any naphthalene trouble, and coincidently improving the coke and the quantity of ammonia, lessening the sulphur content of the gas, reducing the graphitic carbon deposit on the inside of the retorts, and giving comparative freedom from pitched hydraulic mains and from stopped pipes—well, a process with such a combination of merits claims careful consideration and investigation to prove its capabilities.

Such a process is introduced in an article, contributed to our columns this week by a gas engineer who has been interesting himself in it. The system is the invention of Mr. A. Rollason, and is being introduced by the Synthetic Gas Processes Company, of Nottingham. The several advantages are all attributed to the use of a catalyst in the shape of finely ground limestone, which is brought into intimate association with broken coal before carbonizing at temperatures above 850° C. Thoughts naturally revert to the Cheltenham process in which lime is used for primarily reducing the sulphur compounds, and which, Mr. Paterson claims, has brought in its train various secondary advantages. But Mr. Rollason asserts that his proposals, using limestone, are quite distinctive in the principles forming the basis of his invention. The action of limestone, it is stated, is entirely different from that of lime. When intimately mixed with coal rich in hydrocarbons, and with a high oxygen content, the limestone commences to decompose at a lower temperature than that of the resinous and other matters in the coal. Tests on second-grade coking and semi-coking coal, showed that the limestone commenced to decompose at approximately 130° C. As to the quantity of lime to be added to the coal, this varies according to the constitution of the latter and the composition of the ash; but the amount should be sufficient to transform the silicates contained in the ash into neutral silicate. With available an analysis of the coal and knowledge as to the composition of the ash, it is only a matter of simple calculation to arrive at the correct proportion of lime required. The explanation of the actions that apparently take place during the process of carbonization is this: The calcium oxide when freed from its neutralizing agent—carbon dioxide—is in a nascent condition, possessing active chemical and catalytic properties, which assist in the decomposition of the volatile matters and organic bases contained in the coal, and facilitate the combination of oxygen and hydrogen forming water, and carbon and hydrogen forming hydrocarbons, thereby largely increasing the volume of hydrocarbons in the gas and tar. It is due to the reduction of the excess of oxygen by the formation of water at an early stage of carbonization and before the iron sulphide decomposes, that there is limitation of the formation of both oxygenated hydrocarbons and sulphur compounds.

Upon the process, Mr. Rollason has been for some years assiduously working—in fact, the first of a series of patent specifications referring to it dates back to 1911. Probably this was one of the processes to which Dr. Rudolph Lessing alluded in his William Young Memorial Lecture last year at the meeting of the North British Association of Gas Managers [see "JOURNAL," Sept. 8, 1914, p. 571]. Mr. Rollason lays stress upon a knowledge of the composition of the ash in determining the proportion of the limestone to be added to the coal before carbonization. Dr. Lessing said that, in his opinion, the chemical composition of the ash, or, to be more correct, the mineral matter in it, plays a certain part in determining the course of decomposition that a coal undergoes on carbonization. He had not the slightest doubt the lime in the Cheltenham process acted catalytically, accelerating the primary formation of permanent gas and of such tar vapours as are not liable to excessive decomposition down to solid carbon. With regard to the various processes that have been devised for adding to coal lime in the form of limestone or quicklime, we can only support, from observation and deduction from published information, without direct working experience, what Dr. Lessing suggested twelve months ago, that "there cannot "be any doubt that much advantage can be gained by a "more careful study of the mineral constituents of coals "and their artificial modification than has been attempted "hitherto." Data submitted to us as derived from working tests, and from knowledge of the careful inquiry by the gas engineer who has brought the process to our readers' notice, prompt us to recommend further investigation to other gas engineers. The combination of merits seems almost too good to be true; but there are the results from actual working, and there is the encouragement in this direction given by Dr. Lessing. Above all in these times, if a simple process exists that will supplement the country's demand for toluene, and yet give more gas, without depreciating calorific value, improve the secondary products, and relieve gas engineers from the bugbears accompanying high temperature carbonization—well, then, blessed indeed will be the calalytic value of limestone. We hope sincerely that the process will be thoroughly and independently investigated at several works; there is good reason for this being done.

Mr. Newbigging—Revolutionist.

ELECTRICIANS who have read Mr. J. G. Newbigging's paper before the British Association [*ante*, p. 588] have no doubt jumped for joy; for here they have the Engineer of the Manchester Corporation Gas Department, in effect, predicting the evacuation of the lighting field by the gas industry, and leaving it in complete possession of the electric industry. To be precise, so as not to give a larger meaning to his words than was intended, Mr. Newbigging's remark was: "In the case of a municipality controlling both gas and elec- "tricity supplies, there is no reason why the former depart- "ment should not eventually become the gaseous fuel sup- "plier, and the latter the light supplier." He anticipated that he might be described as a heretic by those in control of private gas enterprise. If he is so called by those and others, it will only serve him right; for it is not easy—in fact, it is impossible—to see what inclined him to give voice to such an unorthodox opinion. If abandonment of the lighting business is the correct thing for municipal gas undertakings, then it must be so for private gas undertakings. But in the paper and outside it, there cannot be traced the slightest reason for what Mr. Newbigging suggests. He seems to throw the idea at one, with the questions "What do you think of it? Is it not a brilliant notion?" To tell the honest truth, we do not think it is. There is every reason why gas undertakings should not relinquish the lighting business. If people

want a light of good quality—a light of good illuminating power without high intrinsic brilliancy, and a light of good composition—gas can give it them; electricity cannot. If people want a light that has good diffusive power without external aid—gas can give it them; electricity cannot. If people desire a light that is more reliable than electricity, gas can give it to them. If people want a light that is more economical than electricity, gas can supply it. The gas industry must not deny the people these things, even if it could afford to do so.

There are economic considerations. From dusk, lighting is the staple part of the business of a gas undertaking. The maintenance of this part of the business is of the greatest economic importance to the undertaking. The days were when we were talking much about the levelling-up of the curve of output, in order to realize the utmost possible economy in production, and put the capital expended on much of the works, distribution, and other plant to the maximum possible use. The line of attack for this purpose was to develop the day load; and now Mr. Newbigging wants to put upon municipal gas-works a greater uneconomic yoke by handing them over to larger intermittency. As fuel and not light suppliers, the gas industry would have as a permanent day load (variable with locality and the vacillations of trade) the industrial heating business. There would be the intermittent use of gas-cookers and other kitchen appliances—chiefly in the day time, all the year round. Business would practically cease for the gas undertaking at 6 or 7 p.m. on summer days until next morning. Then, on the coming of winter, a great and variable load—"variable" according to atmospheric conditions—would be provided by domestic gas-fires, which would mean an immense provision of plant, with all the attendant expenses, practically for this purpose alone. A large diversity of business during all possible hours is a factor in the industry's economy; and lighting contributes to the economy. Thus, what Mr. Newbigging proposes would not promote more economical working and cheaper gas—that is to say, as the position is viewed from to-day's conditions. The gas industry will not, we are sure, be prepared to accept his idea without proof of intrinsic merit; nor will the electric supply industry. The electrical engineers are craving for more domestic electrification, so as (they say) to level-up their load, and produce more economic working. In addition to the economic question, Mr. Newbigging's amiable intention appears to be to completely hand over the consumers of gas for lighting purposes to electricity whether they would or no. They would surely have a right to be consulted as to their preference in the matter. We can see our Manchester friend finding himself occupying a position of splendid isolation in this particular matter.

Price is the main thing that stands in the way of a quicker and fuller adoption of gaseous fuel for heating purposes—domestic and industrial. But Mr. Newbigging's idea is not going to lessen the price for heating purposes by eliminating the fat lighting business of the gas industry, unless the proceeding conduces to the production of a lower grade and a cheaper gas. He believes (as we do) that the gas industry has a better opportunity than any other industry of solving the fuel question, and with it the smoke problem; and, after the war, vast possibilities will present themselves. To realize a low price, he thinks that gas of a calorific value of 250 to 300 B.Th.U. would make an admirable fuel, could be produced cheaply, and could be distributed at pressures higher than those now obtaining. The idea is a revolutionary one. There is no evidence as to what would be the effects—economic and in service. Without critical investigation, it is plain that it would mean a large upheaval of everything pertaining to the industry from manufacturing plant onward to the meters, and the appliances by means of which gas is used—involving, too, much scrapping and reorganization in the works of the manufacturers of gas-using appliances by the change in the character of the gas supplied. The millions of appliances, too, that are now in use for gas having a calorific value of 500 to 600 B.Th.U. would have to be adapted to the new low-grade and larger volume conditions; and the factories and businesses of those who supply gas-lighting fittings would have to be scrapped, or be turned over to the making and sale of electric lighting appliances.

The revolutionary picture is not exactly a happy one to contemplate. This is not the first time that there has been talk of supplying gas of a calorific value about half that now distributed; but never has the idea been accompanied by a proposal to abandon all the low-pressure lighting business now possessed by the industry. Several gas undertakings have special power-gas authorization; and a duplicate supply of low-grade gas in industrial areas seems to us to possess about it something of a more practical and feasible nature than the revolutionary ideals Mr. Newbigging puts forward.

A Difference in Heating Business Conditions.

THAT energetic body the National Commercial Gas Association of America are making a contribution to the proceedings of the American Gas Institute at the coming congress at San Francisco; and of some of the papers that they are presenting we give to-day abstracts in our news columns. The papers are varied, and very much to the point. Development of the commercial side of the gas business in America has been taken up quite as something apart from the manufacturing side; and it is proceeding upon purely scientific and technical lines—that is to say, the science of business is applied, and the commercial man must know his subject technically, and be something more than a reciter of prices, gas consumptions, and working capacities. To a large extent, the problems that face the American gas salesman are much the same as they are in this country; but in regard to the question of domestic heating, there is a substantial difference. There is not the same scope there for a gas fire as there is here. The field on this side, given low-priced gas, is practically without bounds; on the other side, there is a limited application through the large vogue of central heating. The gas-cooker has there been the means by which a great increase of gas sales has been effected; but as gas-fires have not the same opportunities as here—generally they are only used in America as auxiliary means of heating, and for employment just prior to, and immediately succeeding, the central heating furnaces being brought into use—the question arises as to how to develop the use of the gas-cooker throughout the winter months; for this seems to be accepted there as the direction in which to increase the domestic business in winter.

On this side, the convenience, and in many places the cheapness of gas, ensure domestic cookers being used well throughout the whole winter. But it appears, from the paper by Mr. R. E. Slade, of Providence, R.I., that this is not so in America. The two obstacles, he says, to the use of gas-cookers in the winter are that they do not heat the kitchen, and they do not supply hot water. We used to say the same thing in this country; nevertheless the cookers are largely used during the winter months, and the use grows. Nothing but convenience, the ever-readiness of the oven and the top plate, and the price of gas can account for this employment in the winter, notwithstanding that a small fire has on the coldest days to be maintained in the range for warming the kitchen. For this purpose coke is the fuel to be used. Now our American friends tackle this question in a different way under their different circumstances. What they do, it seems, is to heat the kitchen from the central heating plant; and Mr. Slade suggests that, by putting a coil in the furnace, hot water is secured at a minimum of expense for household use. This, however, can only be done during the winter; and it, of course, puts an additional tax on the central heating plant. One cannot draw and expend heat units from any system of heating without putting more fuel into it; and all these central heating systems are not large enough to stand the additional strain caused by kitchen heating and hot water supply in winter. Under such circumstances, what Mr. Slade suggests is that gas companies should encourage the installation of large central heating plants, so as to meet kitchen requirements and hot water provision in the winter. We are not intimately acquainted like Mr. Slade with American conditions; but we would venture to suggest that a good alternative to his proposal would be to have a second string to the bow. For large houses on this side, some gas undertakings are developing business in the coke-heated boiler, which is installed in the kitchen, so serving to heat it, and to give a constant supply of hot water through the circulating system. Even our opponents, the electricians, favour this system, rather than have gas-heated boilers put into houses in which they can bring influence to bear. Such a system would be equally useful in American houses practically at any time; and it might induce a shortening of the period of use of the central heating system, and bring other business advantages in its train to the gas industry. Certainly it would do precisely what Mr. Slade suggests, and that is promote the extended use of the gas-

cooker in winter time by making the ordinary kitchen range wholly unnecessary. On this side, too, the gas-heated circulating boiler is providing quite a good and an enlarging branch of business. Why should it not do the same in America, and meet at any rate one of the conditions that Mr. Slade mentions as being up-against the more extended use of the gas-cooker? Is it that, generally speaking, the price of gas in America is too high?

If so, then perhaps the largest possibilities for the gas industry in America lie in the direction of doing what Mr. F. W. Frueauff suggests, in a paper on "Industrial Fuel"—that is, manufacture a gas of lower heat value, which can be produced and distributed at a less cost per heat unit than is now customary. Canada has set an example to the United States; and Canada has come very close to what is the practice in this country—not only in the interest of gas undertakings, but in those of gas consumers, who, with high-grade gas lose heat by the larger quantity of air that has to be introduced to the gas, and which therefore provides a larger quantity of inert constituents which act as a vehicle for carrying away heat from the bunsen flames. For any large development of gas heating in any line the chief essential is—gas appliances being procurable of quite high standard in design and efficiency—a cheap gas of the right composition.

One other point. In Mr. Frueauff's opinion, gas undertakings have not fully realized the importance of technically trained men for developing the industrial side of their business. We are afraid that is also largely the case on this side. Salesmen who have been accustomed to gas lights, cookers, and fires, other than in a few cases, really know but little of the hot-water and the industrial branches of the business; and no slight harm has been done through this. New developments of these kinds almost require special men under the commercial chief—men who can devote time to attaining technical proficiency in the work, so as to take up the exploitation of the business on correct lines. Where an undertaking cannot afford such special men, then steps should be taken to obtain a proper technical training in the new branch for the man already in charge of the sales department. These are really important questions for the managers of gas undertakings—as important, let us say, as the question of whether vertical retorts or horizontal retorts, machine operated from one side of the bench only, should be adopted, or whether telpher or some other form of coal and coke transport should be installed. The policy applied to the outdoor department to-day, without any doubt, settles the measure of stability which will be enjoyed by a gas undertaking in the future.

Dublin again—Where Credit is Due.

THERE is no question that the affairs of the Alliance and Dublin Consumers' Gas Company look healthier to-day, despite the war, than they have done for some time past. But there seems to be some misconception in Dublin as to whom this is pre-eminently due. Bad administration can run an undertaking into deep mire in a short time; and it may be difficult to extricate it. But the extrication in such a case can only be done by specialists, and not by amateurs at the particular work. The latter left alone might make difficulty and loss the more pronounced. In "Anticipant's" letter which appeared in the "JOURNAL" a fortnight ago, the writer appeared to think that much of the late grave condition of the concern was due to the old administration, and that the credit for the more healthy state was due to the new units on the Board. We also see from the notice convening the meeting of proprietors for the 30th inst, that a proposal will be submitted to divide among the Directors resident in England—the new Directors—£1000 for their "special" services, and provide annually additional remuneration of £500 for division among them.

It is a question whether the English Directors are the proper recipients of any extra reward—present and annual. Before this question can be settled, the appeal by "Anticipant" a fortnight ago, and by Mr. R. W. Edwards a week since, should be granted, that publication should be made of the experts' report which divulged the weaknesses in, and indicated the way to increased strength for, the concern—"increased strength" resulting in better public service and profit. The publication of the report, which has been kept secret so long, could to-day do no possible harm, except that it might show up a little more clearly the directions in which the drift and the incapacity obtained which had landed the concern into its difficulties. It might be found then that the uneconomic conditions were not only administrative but technical, and that they were such that no one but experts could have relieved the concern from its accumulation of wasteful burdens and troubles. If this be so, then the directions whence the salvation of the Company has come are to be traced principally to the work of the investigating and reporting experts—Mr. William Newbigging and Mr. W. R. Herring on the one hand, and Mr. William Cash, F.C.A., on the other; and to the work that Mr. Newbigging has since done in producing order from chaos. That so much has been accomplished while the external conditions are so adverse, is an additional feather in Mr. Newbigging's professional cap. While we do not belittle their work as members of the Board, we cannot admit the possibility of three gentlemen passing over from Lancashire to Dublin (expert probably in one industry, but not in such a highly specialized one as the gas industry) bringing to a head those technical changes in works, methods, and administration that have been necessitated at Dublin. If this could be done under such conditions as those which existed at Dublin, then we should be disposed to say that all the work that is done in the training of men for professional service in the gas industry is labour in vain. If special reward there is to be, then it should assuredly be to those professional men who revealed the leakages in technical and administrative parts of the concern, and pointed the way to reform. The provision of an additional £500 per annum for the Directors living in England, and bringing no technical gas qualification to bear on their work, represents on a 5 per cent. basis a capitalized sum of £10,000.

Before the stockholders vote away the proposed sums, they should make it a condition precedent that the report of the experts should be disclosed to them, so as to enable them to judge to whom honour is pre-eminently due. If the report assures them the three gentlemen from Lancashire detected all that was wrong, and suggested the modes of rectification, then the £1000 and the additional £500 a year could be voted to them by the proprietors with hearts in a state of supreme thankfulness. [Since this article was written, a letter has been received from a stockholder in the Company, and it appears in our "Correspondence" columns, suggesting that reform of the concern might with advantage be extended to the Board of Directors.]

Coal Exports.

In the last reference made in the "JOURNAL" to coal exports, it was shown that, at the end of the first year of the war, the reduction in the quantity exported, compared with the twelve months ending July, 1914, was 29,566,410 tons. When the war started, of course the export trade was immediately affected; and the exports of coal which in August, 1913, amounted to 5,819,162 tons fell in August, 1914, to 3,070,742 tons, or a reduction of 2,748,420 tons. In August this year, the amount exported was 3,650,472 tons, or an increase on August last year of 579,730 tons, and a reduction on August, 1913, of 2,168,690 tons. Regarding the increase last month of 579,730 tons, it may be mentioned that France took nearly a million tons more than in August last year. Coke exports are rising. Whereas in August, 1913, they amounted to 113,423 tons, in August, 1914, they were down to 68,498 tons; but in August this year they were up to 89,574 tons—an improvement on August last year of 21,076 tons, though still short of the quantity exported in August, 1913, by 23,849 tons.

A Further Report from Australia.

Following close upon the report of the meeting of the Melbourne Metropolitan Gas Company comes that of the Australian Gas Light Company, who carry on their business in Sydney. The war has evidently affected the operations of the Company, but only to the extent that the increase in the consumption of gas has not been so great as formerly. When the first half of this year is compared with the corresponding period of 1914, there is seen to have still been a substantial gain in output; while taking the year to June 30, and comparing it with the preceding twelve months, an addition to the sales to the extent of 7 per cent. is found. If so satisfactory a result can accompany the practice of economy in the domestic affairs of consumers, and a falling-off in building operations generally, the proprietors have every encouragement

to anticipate with the keenest pleasure a return of normal times. Strong aids to lasting prosperity are being secured through the continued sale of large quantities of gas cooking and heating apparatus—a policy which figures quoted at the meeting prove to have been actively followed. Already the Company have disposed of cookers to about 33 per cent. of consumers; and that the proportion so provided is growing is evident from the fact that, while the number of consumers last year increased by 6013, the number of gas-cookers sold during the same period was 3298, or well over 50 per cent. In addition to the tendency towards economy on the part of the consumers, the war, by rendering it impossible to secure freight from England for materials, has interfered with extension work now in hand; while a miners' strike led to the securing of inferior qualities of coal at greatly enhanced prices and increased freight. It is a pleasure to be able to compliment the Australian Gas Light Company also on the patriotism of their employees, close upon a hundred of whom have taken advantage of an offer by the Directors to keep open the positions and make up the salaries or wages of those who were desirous of serving the Empire.

Sulphate of Ammonia in Germany.

Not much reliable information leaks out as to the position of the internal affairs of Germany; but scraps do occasionally come to hand—some seemingly reliable, while others one does not know whether or not to believe, for the intelligence of one day is often contradicted by that of the next. We may, however, take it that the report of the Deutsche Ammoniak-Verkaufs-Vereinigung is a document that is worthy of credence. There are extracts from it included in the American review of the market for sulphate of ammonia during 1914, as published in our news columns to-day. German middlemen dealing in sulphate of ammonia—the fertilizer required for the maximum production of the national food—appear to have been, during the first months of the war, as greedy for profits as some of our British coalowners and dealers were, with the same result—the Governmental curb was applied. On the outbreak of war, it was soon seen by the German sulphate dealers that, with the restriction of the imports of Chilian and Norwegian nitrates, there would soon be a dearth of tangible nitrogen in Germany. Then the balance between the supply of sulphate of ammonia and the demand began to show a heavier inclination on the side of the demand. The opportunity had come; and the middlemen commenced to reap an unusual golden harvest. The Government intervened; and maximum prices were established. The export of nitrogen was also prohibited. The German Federal Council, as has already been announced in the "JOURNAL," have introduced a Bill for the creation of a nitrogen monopoly in Germany, extending to 1920. But this, it is believed, is being strongly opposed.

Restricting Output.

Reference was made in last week's issue to the speech of Mr. Lloyd George before the Trade Union Congress at Bristol, in which he impressed on his hearers the necessity of the unions suspending during the period of the war all regulations and practices which have the effect of restricting the output of material. In the course of his remarks, the speaker made the grave allegation—in the circumstances, one of the gravest allegations he could have made—that in many cases munition workers and others are not doing, and are not allowed to do, their best. He quoted instances in support of this assertion; and in connection with one which he had referred to as having taken place at Coventry, correspondence has since passed—to the discomfiture of the local Labour Advisory Committee. The fuller particulars now brought to light show that a letter signed "Secretary of Committee," was passed round the works; and in this it was stated a man, who was named, had done in 8½ hours a 31½-hour job. The writer added that this was not the first time there had been complaints of this man exceeding double time; and he wished "all men would spare a minute, and come and have a look at him." The man thus complained about was engaged on a howitzer, upon the prompt delivery of which, perhaps, valuable lives depended; and trade unionists, or anyone else, would find it hard to justify the condemnation of any action which would have the effect of hastening the completion of the weapon. And this instance, be it noted, Mr. Lloyd George quoted as being only one among many examples throughout the country of difficulties encountered over the removal of all restrictions on output.

Profit-Sharing.

In spite of the pessimists, profit-sharing and co-partnership are evidently quite successfully withstanding any test which less prosperous times are in certain quarters believed to impose upon them; and so they are still regarded as the most promising means of promoting goodwill between employers and employed. Up to the outbreak of the war, the adoption of co-partnership principles was making steady progress in the gas industry, and there were converts in other directions. But during the last twelve months it is to be feared most people have had their attention too much occupied by other matters to give thought to domestic developments of this character. We shall not, however, always be at war; and, as Mr. E. G. F. Higginson points out in a letter to the "Daily Mail," there is the future to be considered. Whether or not he is right in his idea that the war has widened, rather than narrowed, the breach between Capital and Labour, there is no need to determine here; for, in any case, there is no doubt such breach as does exist will, as he says, unless carefully handled, prejudicially "affect the improved social conditions to which we all look forward when the victory of the Allies shall have brought the great war to an end." It is for the purpose of healing this breach that he challenges responsible representatives of both Capital and Labour to state their objections to the introduction of a system of profit-sharing into every trade, business, or industry in which it can possibly be instituted. The very considerable experience so far recorded by gas undertakings in connection with the matter will not be claimed on the side of the "objectors."

Non-Explosive Acetylene Gas.—An acetylene gas generating apparatus in which the gas is claimed to be made non-explosive by mixing it with oil gas—the two gases being produced simultaneously—has, says the "Engineer," been patented in the United States. The gas is intended for welding and cutting metal, but may be used also for mine and other lamps, domestic purposes, &c. The cost of production is said to be very low. The generating charge is put up in a sealed cartridge. Water is fed to the carbide, and is under control. The cartridge has a central tube, around which are packed layers of carbide separated by layers of sawdust saturated with crude oil. Sand or other inert material may be used, instead of sawdust. When water is admitted to the central tube, it starts the conversion of the bottom layer of carbide, the heat from which vaporizes the oil in the first layer of sawdust, and so on with the others in turn. The oil vapour serves to absorb any excess oxygen.

Coal Prices and State Control in France.—The French Chamber of Deputies have referred to the Mines Commission for consideration a Bill which has been introduced for the purpose of preventing speculation in the sale of coal. It is proposed that during the course of the war, and in the six succeeding months, the price of coal shall be fixed. In the case of each mine, the sale price of the coal, according to quality, shall be settled by the Government on the basis of the average prices realized in the past five years, and taking into consideration present conditions of working. These prices are to be exclusive of any so-called delivery premium. The Prefect in each Department, on the advice of the local Chamber of Commerce, will be authorized to fix the sale prices to consumers by taking into account the origin of the coal, quality, cost of transport, and a normal commercial profit. The wages of the miners and other wages are not to be less than those prevailing on Aug. 1.

Chemistry and Manipulation of Gases.—In the course of some notes on the portion of Professor W. A. Bone's British Association address which dealt with the economical use of coal [*ante*, p. 581], the Engineering Correspondent of the "Yorkshire Post" says: "Much of the neglect which the question of fuel economy and the proper utilization of coal has suffered, Professor Bone laid at the door of the chemists, who are, he stated, not only lamentably ignorant for the most part of the nature of coal and of modern fuel technology, but have been for many years past so indifferent about such questions that they have been content to leave them almost entirely to engineers, who, as a body, are notoriously deficient in chemical sense and experience. The engineer has not usurped the place of the chemist, but has had to do his best to fill the position long since abdicated by the chemist. Such advances as have been made in recent years have nearly all been in the direction of the wider application of gaseous fuels, yet in how many of our University laboratories is even gas analysis taught? How many of our schools of chemistry provide systematic courses in the chemistry and manipulation of gases, without which no professional training of industrial chemists, however much 'research work' it might include, ought to be considered satisfactory? The answer to the questions would hardly reflect credit on the higher technical education system in Britain, though the record of Leeds University stands out as an honourable and distinguished exception."

JOSEPH HEPWORTH.

DEATH last week removed another of those men who for many years have borne an honoured name in the gas industry, in the person of Mr. Joseph Hepworth, M.Inst.C.E., who passed away last Tuesday, in his 74th year, at his residence, No. 7, Priestfield Road, Edinburgh.

During the past twenty years, Mr. Hepworth's business engagements were of a character which did not bring him prominently before the members of his profession; but previous to that time, for many years, there were few activities of what one may term a public character in connection with the industry among the leading spirits of which the name of Hepworth was not included. His work as Honorary Secretary of the old Gas Institute made him many friends, as did also the performance of his general duties and the extensive private labours which he undertook in Carlisle, where for a period of about a quarter-of-a-century he occupied, with distinction, the dual position of Gas and Water Engineer.

Born at Delph, in Yorkshire, Mr. Hepworth received his engineering training at the Coventry Gas-Works, under the late Mr. W. L. Robinson; thereafter spending three years, beginning in 1867, as Engineer of the Brighouse Gas-Works. In 1870, he entered upon his duties at Carlisle, and immediately found himself confronted—as no doubt he had anticipated when contemplating taking up the position—with ample scope for his engineering abilities. He at once took in hand the task of improving the works, and at the end of five years had the satisfaction of noting that there had been an increase of nearly 34 per cent. in the output of gas. In fact, during his tenure of office, the productive capacity of the works was increased threefold, to his designs and under his entire supervision; the distributing system also being overhauled and improved to such an extent that the unaccounted-for gas was reduced almost to 1½ per cent. Much the same may be said of the water-works, which, under Mr. Hepworth's fostering care, were enlarged, and the profits increased, with a lower charge to the consumers.

When, at the end of his 25 years' work, he left Carlisle, he received many tokens of appreciation and esteem at the hands of the staff and workmen, the citizens, and the Corporation, who decided to ask him to act as Consulting Engineer for a period of two years. This offer Mr. Hepworth did not see his way to accept; but he expressed his willingness to render any assistance in his power should the Corporation at any time require his services in connection with the works. A presentation, subscribed for by the townsfolk of Carlisle, consisted of a silver tea and coffee service, on a handsome silver tray suitably inscribed, a case of silver spoons, forks, &c., and an illuminated extract from the minutes of the Corporation expressive of their appreciation of the services of the recipient. The speeches made on the occasion of this presentation were expressive of the high opinion of his abilities that was held by those with whom he had been closely associated for so great a number of years, and of a recognition of the fact that by his departure they were losing not only a valued official but also a sincere friend.

It was in April, 1895, that Mr. Hepworth severed his long connection with Carlisle; and he did so for the purpose of becoming a Managing-Director [with Mr. W. Henry Cowan and Mr. J. L. Cloudsley] of Messrs. W. & B. Cowan, which firm had just been converted into a limited liability Company. For this purpose, he went to live in Edinburgh, where he resided until his death. The conditions of his new appointment were fortunately stated to allow of his continuing his considerable practice as a consulting gas and water engineer. He designed and carried out various new works and extensions in connection with gas and water undertakings in the North of England and in Scotland; and he was also frequently engaged as a consultant and witness in the Parliamentary Committee-rooms, as well as in connection with gas-works purchase arbitrations, and similar proceedings throughout the country.

In 1891, Mr. Hepworth was President of the Gas Institute; and those members who were present will remember how successful from all points of view was the meeting held in Carlisle that year. It has already been mentioned that for some time he acted as Hon. Secretary to the Institute; and it may be added that upon his retirement from this office, he was, at the meeting in 1896, presented with a handsome silver rose-bowl; the President (Mr. W. R. Chester) remarking that he hoped it would convey in some slight degree the feelings of the members towards Mr. Hepworth, and "their appreciation of the services he rendered so admirably during a critical period in the history of the Institute." Up to the time of his death he was an honorary member of the Institution of Gas Engineers. Mr. Hepworth's election as an associate member of the Institution of Civil Engineers took place in 1877; and he became a full member in 1889. On going to live in Scotland, he joined the North British Association of Gas Managers and the Waverley Association of Gas Managers; and he was also a member of the North of England Gas Managers' Association. The contributions he made to the proceedings of these societies, and his genial manner and desire to assist others whenever possible, will cause him to be sadly missed at the meetings of all these bodies.

The interment was at Grange Cemetery, Edinburgh, last Friday, amid many manifestations of sorrow.

PERSONAL.

The "London Gazette" last Thursday notified the promotion to the rank of Captain of Lieutenant W. E. BROCK, of the Army Service Corps. Captain Brock joined the army shortly after the commencement of the war, and was, prior to that time, Manager of the Denbigh Gas and Water Company.

Dr. J. S. HALDANE, F.R.S., was at last week's annual meeting of the Institution of Mining Engineers at Leeds presented with the Institution gold medal, in recognition of his investigations regarding mine air. In making the presentation, Sir T. H. Holland remarked that Dr. Haldane's work had been of direct humanitarian value to mining communities in every part of the world.

OBITUARY.

"Het Gas" reports the death in Belgium of M. ALFRED BOSCHERON, who had been a Member of Council (and President) of the Belgian Association of Gas Engineers. When acting as Engineer to the Liège and Angleur Gas-Works, he introduced there the "Radol" system of retort-settings, which have vertical regenerative flues, and dispense with the ordinary grate-bars. This system has since been adopted both at Bergen-op-Zoom and Winschoten, in Holland.

The Leatherhead Gas and Lighting Company have lost a promising member of their clerical staff by the death by a shell at the front of Private SELLING DANIEL SMITH, of the 23rd London Regiment. Mr. Smith (who was the younger son of the Epsom Manager of the Wandsworth, Wimbledon, and Epsom Gas Company) enlisted about twelve months ago, previous to which time he had been for about seven years a clerk in the offices of the Leatherhead Gas Company, by whom his death is felt to be a great loss.

The body of Mr. THOMAS BOWER, whose death was recorded in last week's "JOURNAL," having been brought from Wales, was interred last Wednesday in West Hartlepool Cemetery, after a largely attended service in Wesley Church, the congregation at which included many representatives from the Gas and Water Company, various public bodies, a number of gas managers, Freemasons, and others. Among others present were Mr. O. K. Trechmann (Chairman), Mr. William Scott (Secretary), and Mr. A. W. Branson (General Manager), of the Hartlepool Gas and Water Company. At the close of the service, the body was borne down the aisle by members of the staff of the Company. The large number of floral tributes included one from the North of England Gas Managers' Association.

ELECTRICITY SUPPLY MEMORANDA.

THE "Electrical Times" does not appear to be altogether pleased with the report of the Departmental Committee on the Lighting of Factories and Workshops; and "Meteor" has expressed his opinion of it in extremely fiery language.

The Sin of Impartiality.

It is apparently not what he expected, in view of the electrical element in the composition of the Committee, with not a single member possessing direct association with gas lighting. The impartiality of the Committee is magnified and magnified until it amounts through the meteoric pen to a sin of the blackest character. But we rather incline to think the men composing the Committee will ignore the very stupid and violent outburst. "Meteor" constitutes himself a competent judge. He could have done much better than the Committee without going through any such nonsense as an inquiry, and spending money on investigations, reporting, and the printing of reports. Which is the best light for factory and workroom lighting? And the straight answer would have come from the biassed "Meteor"—"Why electricity of course;" and reasons for the reply would not have troubled him. In fact, he does not deign to give any reasons for his hysterical outburst upon the Committee, save that he leaves his readers to infer that he does not like the report, because it does not say the electric light is the light *par excellence* for all purposes, which is a very silly attitude, and the Committee know it to be so. If this is not the meaning of what "Meteor" has written, then we have not properly interpreted it; but we undertake to say that no one else could put any other interpretation upon the amusing tirade.

The Folly of Blind Partiality.

We are pretty safe in our interpretation. "For sources of light," the Committee wrote, "incandescent gas and electric light are now far the most widely used." "Meteor's" comment is: "Ten years ago, incandescent gas was, in proportion, far more widely used than electric light. Are vanishing conditions of much use to us? Is it not mischievous to instance a predominance which is rapidly disappearing, and to hold it up for future public guidance." Rather more than twenty years ago, the gas industry had only *half* the annual business in

gas that it did in the year preceding the war; and at the earlier period it had comparatively little daylight consumption. In the two decades, it doubled its annual gas business; and from 40 to 50 per cent. of the business of many concerns is represented by day consumption—leaving upwards of 50 per cent. (or more than the business of the days when electricity supply through general distribution systems entered the field) for the hours of darkness, notwithstanding the fact that the wasteful flat-flame burner had large prevalence twenty years ago. What does it mean? More business during the hours of darkness, and yet economical incandescent burners are prevalent now—a cubic foot of gas giving 20 to 25 candle-hours where it only gave 2 candle-hours before. "Vanishing conditions," a predominance "rapidly disappearing!" What an amount of folly there is in a partiality that is blind to concrete facts! The knowledge of our friend placed against the actual facts makes his censure of the Committee and their report all the more ludicrous.

The "Best Illuminant" for Workers.

"What concerns the workpeople's welfare is which illuminant is the best?" We are not certain that the definite determination of this point was part of the reference to the Committee. They were to inquire and report as to "the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the persons employed, and the various forms of illumination." Because the Committee did not say electricity is the best, they have been spending money on "the perpetration of a mediocre joke;" and "really is it not squandering the public funds to conduct such careful investigations as these, and then to publish a silly travesty of the results?" So speaks the petulant "Meteor" of the report to which the names of Dr. R. T. Glazebrook, C.B., F.R.S., Mr. Leon Gaster, Dr. J. Herbert Parsons, Professor C. S. Sherrington, D.Sc., F.R.S., Mr. W. C. D. Whetham, F.R.S., and Sir Arthur Whitelegge, K.C.B., are attached. These men, says the critic (who is not over-prudent in the choice of his terms), "are absolutely determined that gas shall be regarded as of equal value with electricity, and what possible profit can be derived from an assumption which amounts to scientific falsehood." Now what are the facts? The National Physical Laboratory experiments with seamstresses and tailors show that workers prefer a direct light, not an indirect one; and the indirect system is shown to be most uneconomical by the time the degree of illumination with it is reached which the workers want, and which can be obtained for a lower expenditure by direct lighting. But the ophthalmic surgeons say that the complaints of eye trouble they receive are largely attributed to working by electric light; and they in consequence recommend indirect lighting, or the use of other forms of screen. The recommendation of the ophthalmic surgeons is therefore opposed to the practical requirement of the workers. This being so, it is preferable that of the two commonly used illuminating agents, the high intrinsic brilliancy one should not be recommended. That the intrinsic brilliancy of incandescent mantles is much lower than that of metallic filament lamps is a scientific fact and not a scientific falsehood. Under these circumstances, which is the better illuminant for the workers' use? Surely not the one of high intrinsic brilliancy. There we have the answer to "Meteor's" declaration: "What concerns the workpeople's welfare is which illuminant is the best?" The deduction is readily made from the report and appendices as to the superiority for the eyes of workpeople of the light of relatively low intrinsic brilliancy, and the light that can be adjusted to the needs of each worker by the worker himself. Among other foolishness in the strictures of "Meteor" is this: "Violent fluctuations in gas-mains are shown to have caused complaint." Perhaps the writer of this statement will give us chapter and verse for it, as well as describe what he really means by condescend to "violent fluctuations."

Voltage Surges.

In the confusion caused by the overloading of their minds with ideas derogatory to gas, and the rejection of all that is said favourable to gas as being simply too absurd for their acceptance, electrical engineers give vent to most inflated statements concerning the popular rival. Small local variations of gas pressure, for example, have most remarkable effects in the abstract, but in practice these effects are not noticed. A singular thing, however, is that a condition that is assumed to be so fruitful of trouble and bad result in the case of gas is not so in the case of electricity. Modern electric apparatus, some not over-conscientious electrical men assert, is oblivious of the small variations of voltage that occur in the electricity systems, and some electrical purists go so far as to say there are never any variations of voltage worth the description. The honest ones do not agree, though naturally they do not go out of their way to tell the public the truth of the matter. There has been a good deal said lately about electric surges, and to the need for protecting plant against them. Electrical systems, says one writer on the subject, are never at rest. Surges of some dimensions or other are continually passing to and fro along the mains; and while in the past breakdowns of generators and transformers have been attributed to defects in the insulation of the machines, many have really been due to the stresses imposed upon the insulation by the accumulated magnitude of the surges arising from some unknown causes. The General Electric Company have been studying this question, and announce their ability to undertake the complete protection of electrical systems against any voltage surges. To four principal causes are due the voltage surges occurring in alternating currrent systems: (*a*) Resonance, (*b*) switching, (*c*) arcs and sparks, and (*d*) lightning effects. We will not describe the condenser which is the apparatus used for preventing damage, because our readers would not be very interested in it, even when they learn that it is the "only surge protective device which modifies the wave form of deep-fronted waves." What interests our readers more is that voltage surges require the use of such apparatus to effect reductions. There is nothing new in this; it is only that these pressure surges have become more pronounced with the increased variable demand upon electricity systems. But the one device will not protect against all conditions; and a supplementary device is required. For example, while a condenser will, it is said, protect against excess pressure of high frequency, and against steep wave front, with it must be installed a complementary device to protect against surges of low frequency and high voltage.

Chimneyless Rooms.

The "Electrical Review" has just been publishing a series of articles on "The Selling Side of Electricity." In No. 4 there is advocacy of the chimneyless room, against which hygienists and doctors protest, especially when the rooms are used for nocturnal repose. The chimneyless room suggests something of box-like dimensions and appearance; and the incarceration of one's self in such an "apartment" would, we imagine, be sufficient to give one nightmare. The "Review" says that "a feature of several new blocks of flats recently erected in London has been the elimination of fire places in certain of the rooms, principally bedrooms." The considerations that have led to this change have been economy of space and the clean sweep and larger effect of the unbroken walls, which add considerably to the attractiveness of the rooms, and leave the occupants more choice in the placing of furniture. Weak, dear "Review"—very weak! The need of the economy of space by the elimination of the fireplace suggests a sort of rabbit-hutch; and unbroken walls a monotony. Given these unbroken walls and the monotony of light reflected from the ceiling, and the occupant of such a room might speedily be a candidate for a lunatic asylum. A central feature on one side of the room such as is provided by fireplace and mantel adds, in our opinion, to the attractiveness of a room, and is not a detraction. Then the argument goes on that there is a saving of material for fireplaces, mantelpieces, tiling, and chimney pots. So there would be if there were no furniture, and the occupants lived with space, as well as walls, unbroken, so contributing to what the "Review" case-maker for electric heating calls "attractiveness." Is it a fact that there are any bedrooms constructed in London without chimneys or flues in them of some kind? We have always understood that the London Building Acts require some such provision.

Electrical Absurdities.

The "Review" writer goes on to say the ventilating value of a chimney is trifling when a fire is not "on;" and the open window is far more healthy. How remarkable! We submit that the open chimney is valuable even when a fire is not "on;" and especially when, summer being over, the occupants of rooms have a singularly common practice of closing windows tightly. The hygienic value of a chimney is not to be destroyed by vapid sentences such as find accommodation in the "Review" article. Then we go on to read that, when there is a coal fire, there is a risk of the chimney smoking; "a down-draught being particularly dangerous in such a common complaint as bronchitis, or, in fact, any ailment connected with the respiratory organs. This risk is, by the way, equally present with a gas-fire, perhaps in larger degree, owing to the fumes being invisible." That really is about the most silly statement in the article. All chimneys are not defective; and, suffering from bronchitis or any other ailment associated with the respiratory organs, we would rather be sleeping in a room with a chimney than with our own organic emanations, and no outlet for contributing to the change of the air of the room. We have a big healthy population, judging from the health statistics, and by comparison; we have now the biggest Army and the biggest Navy that we have ever had; and all the components of population and active Army and Navy have been brought up in rooms with chimneys in them. May we be preserved from these electrical fanatics, whose one and only object in advocating the abolition of chimneys in new residences is to try to secure the larger installation of electric-heaters, without a care for the contribution they are making to the enervating conditions of life. Gas-fires are being largely used and recommended by the medical faculty, because of the large percentage of radiant heat given off; because of the up-draught created in chimneys, thus promoting ventilation; and because, with the modern construction of fires, there is efficient guard against escape of the products of combustion. If the writers on this subject in electrical papers had an analysis of the products of combustion of a coal fire, and then of a gas-fire, they would wonder how it is that, with down-draught chimneys and the poisonous emanations of a coal fire, they are alive, and providing the evidence of a personal limitation of intelligence, from which men possessing scientific knowledge of these matters—men who have been brought up, and have lived all their lives, in rooms possessing fireplaces and chimneys—gather amusement, or by which their pity is excited.

The Originator of the Retrospective Clause.

Colonel A. Sinclair, of Swansea, must be a proud man to-day, but it is a pity the Corporation have not the power to award him a "D.S.O." or some other substantial mark of distinction for his services. However, they have done the next best thing; they have cordially thanked him. It seems, according to the "Electrical Review," that the Colonel was instrumental in inducing the Executive Committee of the Municipal Electrical Association to take up the question of the exclusion of existing contracts from the Coal Prices Limitation Bill; the result being that, now they are included, contracts entered into prior to the passing of the Act would, with certain conditions fulfilled, benefit—not as the "Review" puts it, "to the extent of 4s. per ton, but to the extent that the contract prices at the pit-head exceed 4s. per ton on 1913-14 contract prices. We rather imagined that other men and other bodies had a great deal to do with bringing the retrospective clause into existence. But now we know, on the authority of Colonel Sinclair's Swansea friends, and the publication in the "Review."

Life of "Half Watt" Street Lamps.

Careful records are being kept by the Hamilton (Canada) Hydro-Electric Department of the life of different types of street lamps. During 1914, the city installed some 1000 500 watt nitrogen-filled lamps; and a report, dated May 22 this year, states that 977 lamps had given a total of 1,456,848 hours of light. This is an average of 1491 hours per lamp, including all defects. Some of the original lamps were at the date mentioned still in operation. It would be interesting to have particulars of costs per lamp, with initial outlay.

HOW TO COOK BY ELECTRICITY.*

Cookery teachers and demonstrators who become identified with the art of cooking food by the aid of electricity appear to think it necessary that they should figure as authors of cookery books. Consequently, the electrical cookery books that have of recent years courted the attention of those interested in the subject are beginning to show bulk. Both the ladies whose names appear on the title page of the book now before us—Miss Amy Cross and Miss Alys Waterman—we have heard of before; and Miss Cross's efforts with brain and pen in the cause of electric cooking have been under our criticism on previous occasions. The present book is entitled "How to Cook by Electricity." At the top of the introductory pages, it says: "Please read carefully before using the recipes." The book has been read carefully by the reviewer, not before using the recipes (because he does not know much about them), but before writing the review. As a result, it may be at once said that there is not much in the book of which complaint can be made from the gas industry's point of view. There have been cookery books of electrical origin which have spoken very ill indeed of the popular competitor. "Poisonous gas fumes" have been mentioned, and much else said that has been not only childish but slanderous, and which disclosed a complete want of acquaintance with elementary considerations affecting the subject. We congratulate Miss Cross and Miss Waterman on having the good sense to abstain from making (excuse the word, there is no other fitting term) fools of themselves in the eyes of those whose scientific knowledge enables them to find amusement in the method of treatment by some electrical cooks of matters upon which they have attested perfect ignorance. Naturally, the joint authors make out the best possible case they can for electric cooking; but they show a large amount of discretion in screening by omission the other side of the case. Electric cooking, they say, "is easy." If the numerous instructions in the book mean anything at all, it is not so easy as the gas method. "It is clean;" and so is the gas way. "It is safe." Nothing is said of shocks and breakdowns. "It is hygienic;" and so all tests applied to the gas method show it to be. "It is up-to-date." Not in economy of money and time. From first cost onwards, expert testimony as well as experienced users show that the hands of the latter have always to go deeply into their pockets. "It is scientific." The book shows the necessity for the application of laboratory methods, and of a perpetual struggle against loss of heat. "It ensures perfect results both in the appearance and in the flavour of the food cooked." That is merely a matter of opinion. We have seen the smile of the investigators of the products of electric-ovens. "Meat cooked in an electric-oven loses much less weight than when cooked in any other way; and this means a large decrease in the butcher's bill." The loss is altogether a question of the cooking temperature and the constitution of the meat.

It seems that what the authors regard as "scientific" cooking is cooking by the use of a thermometer in the oven. With a thermometer it is said "more certain results" can be obtained. Yet later on, we get the authors acknowledging that definite temperatures cannot be given by them because there is as yet no standard electric-oven; and therefore they do not claim that the temperatures named in the book are the best for every type of oven. Let us also suggest to the authors that there are no standard joints of meat—that weight and constitution of meat differ greatly. Then, again, the temperatures given by a thermometer used as the authors advise are not the actual temperatures inside the oven. They themselves admit that a thermometer suspended inside the oven would return higher readings. The heat-measuring system they advocate, so as not to waste the precious heat by opening and closing the oven door, is to have a thermometer fixed in the centre of the door of the oven, but registering outside, and projecting inside about 2 inches. What on earth is the use of a thermometer fixed in this way? It must misguide, instead of guide, the user. In a note on p. 17 of the book, it is stated that "different types of ovens vary a good deal in the time they take to heat." This is so with ovens of the same cubical capacity; and it is due not only to construction, but to external draughts and temperatures, which vary with the seasons of the year. The starting and subsequent external temperature of the casing itself, as well as the question of whether an oven is packed or unpacked, and the losses great or small by radiation, must always more or less affect the amount of current required for heating-up to, and maintaining, a given temperature. If these conditions affecting temperatures are pieced together, do they not suggest to the authors that there may be a considerable difference made by external cooling influences and the temperature of the casing (especially in the winter) upon the registration of a thermometer fixed as they suggest through the casing? Upon the whole, therefore, we are not persuaded, by the application of the law of cause and effect to this matter of the thermometric control of the domestic electric-oven, that the authors have made out a good case for it.

A new race of cooks will have to be developed (of the Girton girl type) before the thermometric control of oven temperatures will become the vogue in the kitchen; and with thermometric control much wrong information is given. But the authors have cajoled themselves that this is not so. On the other hand, they are of opinion that, where thermometers are not used as prescribed, a good deal of guesswork prevails; but the guesswork is made easier by the fact that the electric current "never" varies. Is it possible that Miss Cross and Miss Waterman do not know anything about the variation of voltages in an electric system? It also appears that another thing that, in the view of the authors, confers upon the electric cooker the title to "scientific" is that the oven is not ventilated but is made practically airtight. We cannot bring ourselves to subscribe to the idea that baking or roasting in a steam-supersaturated atmosphere is "scientific."

The authors aver that there are two reasons why an electric-oven is cheaper to use than one heated by coal or gas. One of these reasons is sufficiently covered by the statement that the ovens are air-tight and heavily packed; so that this would not apply to unpacked or lightly packed ovens. The thermal value of gas and electricity for a given price apparently does not enter into the reckoning. The warning, however, is given that if economy is required with the electric-oven the door must be opened as seldom as possible. The second reason adduced is "that meat cooked in an electric-oven loses very much less weight than if cooked in any other way." Of course, this is very silly. It was acknowledged to be so in the discussion on Mr. Cooper's paper before the Institution of Electrical Engineers. Loss of weight in cooking in an oven is entirely a question of temperature and constitution of meat. The authors themselves do not apparently appreciate this, although they, like their readers, may arrive at the conclusion by applying a little common sense to certain points in the book. Users are advised to leave the heating elements of the oven on at full heat for from 15 to 30 minutes before putting in any food. A little later on they are told that beef requires for cooking 20 minutes for every pound, and 20 minutes over; mutton 23 minutes for every pound, and 23 minutes over; veal or lamb, 25 minutes for every pound, and 25 minutes over; and pork, 30 minutes for every pound, and 30 minutes over. "This rule applies to joints of 5 lbs. and over; smaller joints require a proportionately longer time." On the next page, it is stated: "It is quite possible to cook meat in an electric-oven as quickly as in any other oven. By using higher temperatures, only 15 minutes to the pound and 15 minutes over need be allowed." The slower method given above is, however, strongly recommended for the following (among other) reasons: "Many of the valuable juices of the meat are retained which would otherwise be lost." What does this mean if not that the measure of shrinkage has relation to the degree of temperature? It is possible to work a gas-oven at high or low temperatures; and at any intermediate point, which is not the case with an electric-oven. What, then, do the authors mean by their random statement that meat cooked in an electric-oven loses much less weight than if cooked in any other way?

In speaking of economy, the authors omit to point out that something like 70 per cent. of the cooking of a household is done on the hot-plate. Nor do they say anything about the inefficiency of electric hot-plates, the slowness of boiling on them, and their breakdowns. These things were said recently within the four walls of the lecture theatre of the Institution of Electrical Engineers, from which the public are excluded. Perhaps the authors consider that sufficient indirect warning as to the hot-plate is given to users by the statement that "the greatest economy of electric cooking is to be found in the work of the oven." Regarding the grill, the user is urged not to touch the wires with any metal—knife, fork, or spoon—as this might seriously damage the grill. It is too bad of Miss Cross and Miss Waterman to have omitted all reference to the fact that the person handling the metal implement might also show a surprising amount of agility.

* "How to Cook by Electricity." By Amy Cross and Alys Waterman. London: Lake, Sison, and Brown, Limited. Price 9d.

THE DAVIS COMPANY'S 1915 SERIES OF GAS-FIRES.

Side Ventilating and Other Features.

ALWAYS attractive, the sumptuously equipped gas exhibition *salons*, in Oxford Street, of the Davis Gas-Stove Company, Limited, possess at the present moment an additional feature of interest, in the specimens that are on view of the firm's 1915 series of gas-fires, which embrace various improvements calling for note. In drawing attention to the structural details, too, it would be remiss not to state that, from an artistic point of view, the very best effects have been secured in the design of the new season's fires, one pattern or another of which should be found to suit the taste and the needs of the most exacting architect or consumer, as it certainly will harmonize with any scheme of interior decoration.

The Davis Gas-Stove Company remark that, as exhaustive scientific research has demonstrated that the comfort of a living-room is mainly governed by the four factors of air temperature, radiant temperature, relative humidity, and air movement, their 1915 series of fires have been constructed to meet these conditions to the fullest possible extent. Primary convection currents are minimized, and their temperature is substantially reduced. The radiant temperature is under ready control, and is thus made adjustable to varying room conditions. Normal relative humidity is consistently maintained. Air movement is increased by improved ventilating provision, under adequate control, to meet variations in chimney draught and other influences.

SIDE VENTILATING.

To take the last aim first, this is attained by the provision of a ventilating device which carries into effect the view of the firm that any secondary ventilation—that is to say, ventilation other than that which is derived from the canopy itself—should be by means of side panels, with adjustable dampers. The advantage sought by this method of ventilation is to obviate the draught one may be liable to experience, according to the degree of ventilation, when sitting close to any fire ventilated wholly by the canopy. With side ventilation, of course, the draught is at any rate divided in two, one-half at either side of the fire; and the draughts do not pass over the radiants. Furthermore, the secondary ventilation can be entirely shut off, should circumstances warrant this, or it can be regulated to a point of extreme nicety. These operations are performed by the opening and closing of the hinged dampers by means of a sliding knob.

An explanation, with diagrams [taken from a pamphlet just issued by the Company, on "Domestic Heating in its Relation to Personal Comfort"], of the origin and development of the ventilating gas-fire, is reproduced at the close of this article. This is accompanied by the opinion of Mr. A. H. Barker, B.A., B.Sc.—a distinguished heating and ventilating authority—that to allow the secondary air to pass to the chimney by way of side grating-panels controlled by dampers is "vastly superior to the other;" the "other" being the alternative method of ventilating by means of a secondary air passage above the canopy.

THE INTENSE-FLAME BURNER.

This year's fires differ from their predecessors inasmuch as they have a rectilinear front, whereas a curved front has been the design adopted in former years. This alteration has involved the reconstruction of the burner; and advantage has been taken of the opportunity afforded by this to effect several improvements in it. One of these improvements consists in the placing of what is termed an "intensifying plate" between the lower portion of the burner and the nozzle-piece. This has the effect of dividing the gas into very fine streams and ensuring a complete mixture of gas and air, and therefore silent combustion.

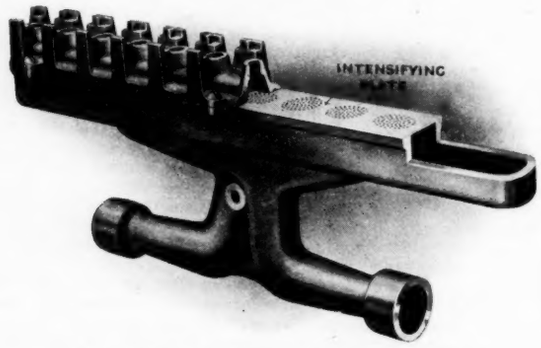


Fig. 1.—The Davis Intense-Flame Burner (Duplex).
Section showing the Intensifying Plate.

A SILENT INJECTOR.

To further secure that the gas-fire shall be silent in operation, there have been devised a patent silent injector (which is a new gas and air regulating device), and also a pressure damper, for dealing with any cases of initial pressure other than would naturally produce a silent flame.

The illustration and the following short description will make the working of the injector clear: The small pin A is free to rotate by pressure of the thumb or finger through three-eighths of a circle, and in so doing causes the shield B to rotate also, thus reducing or increasing, as required, the quantity of the gas passing. The spring D ensures that the surfaces B and C shall be in

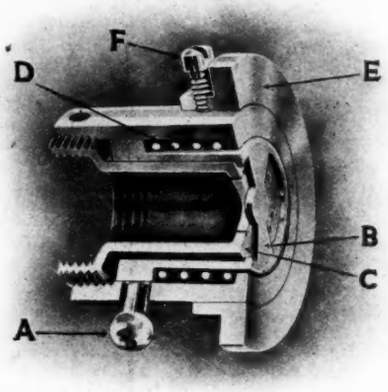


Fig. 2.—The Davis Silent Injector.

gas-tight contact, and that the pin A shall not rotate except as intended. At E is the air-slide, provided with a locking-screw F. By sliding the disc against or away from the burner-mouth, complete regulation of the aëration is obtainable, making possible the range of efficient flames shown in fig. 4. The gas cannot at any time be shut off at the nipple—the regulator having definite stops at the maximum and minimum positions.

THE PATENT PRESSURE-DAMPER.

Dealing in the same way with the patent pressure-damper, it may be explained that the gas enters at A from a cast-iron float, and passes around and through the perforated cone B to the outlet C. The cone B may be caused to slide within the enlarged tube D, by means of the eccentric pin E, operated by the spindle

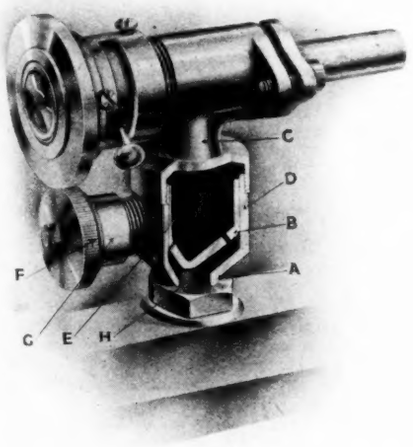


Fig. 3.—The Davis Pressure-Damper.

F, which passes through the gland and stuffing-box G, to prevent gas leakage. In this way, the space H, between the cone B and the sloping surfaces of the enlarged tube D, may be increased or decreased [yet always affording a passage for the gas], according to the requirements of the then main gas pressure. The Davis

pressure-damper may to a certain extent also be used to control the aëration of the flames; aëration being lessened as the gas pressure at the injector is reduced, and the size of the latter increased.

The intensifying plate, the silent injector, and the pressure-damper have the combined effect, if the last two are properly regulated, of enabling the adjustment of the radiant intensity of the fire to any conditions under which it may be burning; the view taken by the Company being that the same degree of radiant intensity is not necessary, or even desirable, for every room into which the same pattern of gas-fire may perchance find its way. With the devices introduced, they point out that they can provide a small room, with people seated near to the fire, with a radiant temperature of low intensity, and a larger room, with

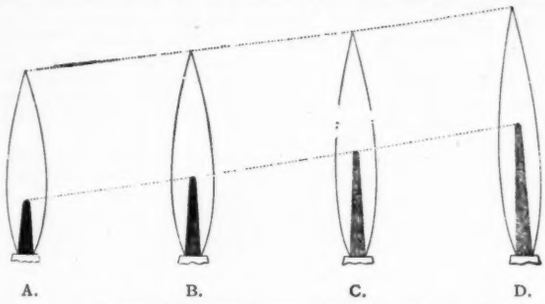


Fig. 4.—Range of Efficient Flames Obtainable with the Davis Intense-Flame Burner.

radiation of very much more powerful intensity from one and the same fire. In fact, they claim for this burner, with the various improvements, that it will give a very wide range of efficient flames. Fig. 4, already referred to, shows such a range of flames. A has a maximum aëration, and therefore most intense flame. It has a small dark cone, and is the lowest of the four flames. B has a slight reduction of the aëration, suitable for large, but not for the largest, rooms. C has further reduction, and is a normal and average flame; while D shows the limit of deaëration, giving a flame suitable for very small rooms, and for sitting close to the fire.

Another point about the burner is that for the larger fires—ten flame and upwards—a new form of duplex burner is provided, which is controlled by two separate taps; one on either side. In this way, with (say) a ten-flame fire, one can have the whole of the fire burning with any degree of reduction, or six or four flames, and in either case also with any degree of reduction.

From the maintenance point of view, the burner is all that can be desired. It is simplicity itself; consisting, as it does, in whatever size, of only three parts—the nozzle-piece, the intensifying plate, and the main casting.

Alignment of Fuel and Flame.

Reference should be made also to the provision for securing constant and invariable alignment of each pillar of fuel with its own particular flame. Uprights—two (slotted) at the back of each nozzle, and one in front, standardized to fit the fuel, and in which the bottom end of the fuel rests—ensure the absolute maintenance of that alignment with the flame which it is so desirable to secure.

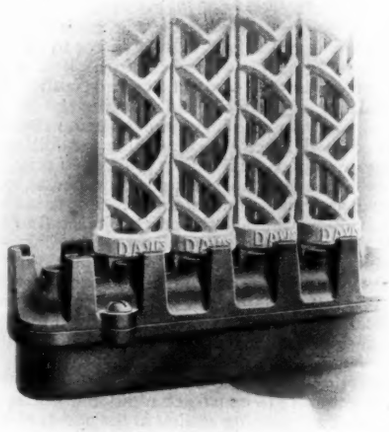


Fig. 5.—Securing Fuel and Flame Alignment.

Built-in Fires.

In addition to the series of 1915 fires embodying the features just described, the Davis Gas-Stove Company have introduced something else which they have every confidence will prove extremely attractive, and in thorough keeping with the modern trend of gas heating. There is, they point out, a growing tendency on the part of architects to specify gas-fires for dwellings about to be erected; and they have designed a set of beautiful fires which, when they are fitted (an operation as simple as can be wished), have the appearance of being part of the fireplace.

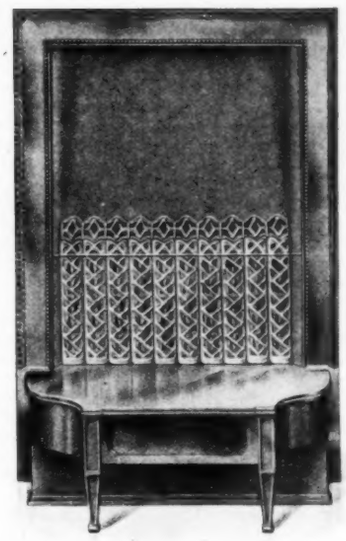


Fig. 6.—The Davis "Adam" Fire.

These fires do not stand out from the surrounding tiles; and they are suitable for any position, being designed to harmonize perfectly with all styles of modern interior decoration, as well as those of earlier well-known periods. No architectural work could be too simple or too elaborate to be matched by one or other of the fires and surrounds which are on view in the Davis Company's *salons*. The requirements of Adam, Tudor, Jacobean, or Georgian styles can each and all be met in a manner worthy of their very best traditions. These flush surface—if they may be so termed—built-in fires gain an added lustre by being fitted with a heavy plated trivet, which gives the effect of an increased radiating surface.

ORIGIN AND DEVELOPMENT OF THE VENTILATING GAS-FIRE.

The following is the extract from the Davis Company's booklet, alluded to in the course of the preceding article:

The First Ventilating Gas-Fire.

The first ventilating gas-fire was made in 1905 by a well-known Yorkshire firm—the idea, however, having been originated by the South Metropolitan Gas Company.

Original Davis Ventilating Gas-Fire.

Shortly after this, we [Davis Company] introduced our first ventilating gas-fire. In this, two passages were provided—both connected with the chimney; one consisting of a flue for the escape

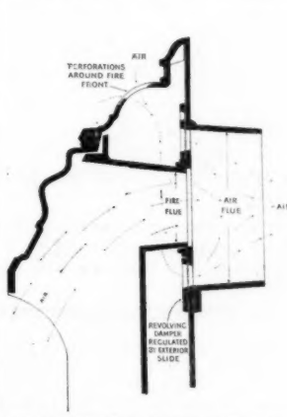


Fig. 1.—Section showing the Construction of the First Davis Ventilating Gas-Fire, 1906.

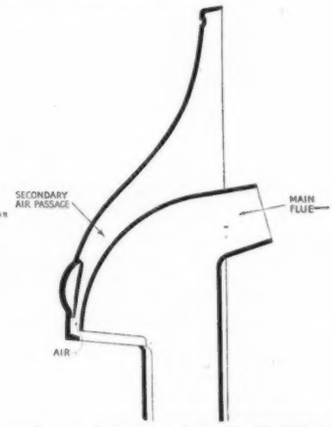


Fig. 2.—Section showing the Secondary Air Passage of the Davis Hygienic Gas-Fire (1911-14).

of the products of combustion, the other (surrounding the first) a course for the passage of ventilating air, regulated by means of a sliding-damper. This arrangement is clearly shown in fig. 1.

Ventilation of the Hygienic Gas-Fire.

In 1911, we introduced the Davis series of hygienically perfect gas-fires, in which primary ventilation was assisted by an enlargement of the flue outlet, and a carefully proportioned secondary air-port, was also provided. This construction is shown in fig. 2.

Excessive Canopy Ventilation Undesirable.

Our own later experience, coupled with the research of the best-known authorities, has dictated a re-introduction of the adjustable secondary air passage, with perfections and modifications designed to overcome the objections that might legitimately be raised against an extension of our 1911 principle.

In this, as will be seen from fig. 2, all the secondary ventilating air was introduced at the canopy edge. A mere enlargement of the secondary air passage would, therefore, have the effect of causing an undesirable draught around the front of the fire.

Side Ventilation Preferable.

Exhaustive tests in our own laboratories, as well as the considered judgment of the foremost experts, confirm our view that secondary ventilation, to be perfect, should be mainly effected around the sides of a gas-fire, where its velocity can be kept low, and where it can be adequately controlled.

In this connection, mention is made of Mr. A. H. Barker's emphatic opinion, in reply to the following question: "In the case of a gas-fire which is to change the atmosphere in a room three times per hour, is it more satisfactory to cause the whole of the ventilating air to enter the chimney beneath the canopy, or to allow a large portion of it to pass to the chimney by way of perforations through the side of the fire—in the latter case, arrangements being made for adjusting dampers controlling the amount of secondary air passing?" Mr. Barker's emphatic reply was: "I have not the least hesitation in expressing my opinion as entirely in favour of the second proposal—namely, to allow the secondary air to pass to the chimney by way of the side grating panels, controlled by dampers. In my judgment, this proposal is vastly superior to the other."

Side Ventilation with Adjustable Dampers.

In the Davis 1915 gas-fires, ventilators with adjustable dampers are fitted at either side of the fire, and being operated individually, permit of a wide range of adjustment by the simple

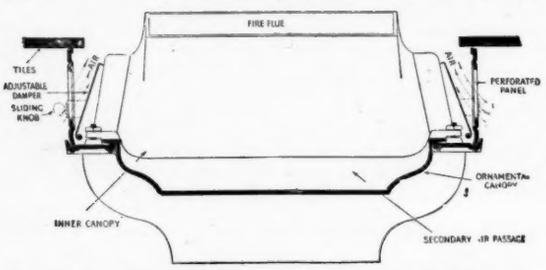


Fig. 3.—The Davis 1915 Gas-Fire Construction. Plan showing the Side Ventilating Arrangement and Adjustable Dampers.

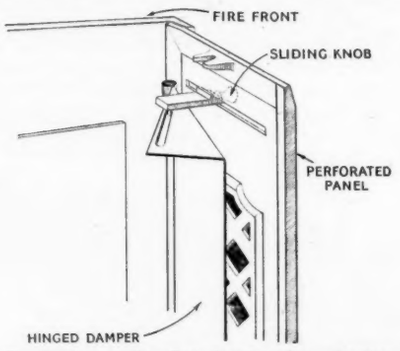


Fig. 4.—The Davis 1915 Gas-Fire Construction. Section showing the Operation of the Hinged Damper.

operation of moving a sliding knob backwards or forwards, in this way opening or closing the dampers, according to the degree of ventilation required. Figs. 3 and 4 illustrate this new and improved arrangement.

English Coke for France.—At last month's sitting of the Central Coke Committee for France, the stock of coke on the 1st of July last, excluding the districts in the East, North, and North-West, was stated to be 149,532 metric tons, compared with 169,115 tons at the corresponding date last year—a decrease of 19,583 tons, or 11·5 per cent. The Committee took into consideration the question of the importation of English coke into France, in order to meet the requirements of manufacturers who are engaged on work connected with the war, and to prevent the domestic consumers from being deprived of a supply of this useful fuel during the coming winter.

WATER LEGISLATION FOR 1915.

[First Article.]

In preceding issues of the "Journal" the principal features of the Gas Acts and Provisional Orders for the present session have been indicated. We now deal with the measures relating to water supply—taking first those promoted by companies.

The Frimley and Farnborough Water Act confers further powers upon the Frimley and Farnborough District Water Company. Under section 15 of their Act of 1909, the quantity of water to be pumped from the well at Odiham was restricted to 500,000 gallons per day. By the present Act this is increased to a million gallons; and the Company are not to be liable to any penalty or proceedings in respect of any day in which they shall exceed this quantity, if the excess is rendered necessary "by military requirements within the limits of supply of the Company during the continuance of the present war and two years thereafter, or by the temporary breakdown of the Company's Itchel pumping-station." Section 27 of the Act of 1909, dealing with cases where existing wells are affected by pumping operation, is amended; and it is provided that if it shall be proved that pumping at the station specified in the section has caused any diminution of the supply in any private well existing at the time of the passing of the Act, or constructed before March 1, 1915, and in either case situated within a radius of three miles from the station, the Company are, upon the written request of the owner, lessee, or occupier of such well, to afford him a supply of water equal to the amount of the diminution, and repay to him any outlay incurred in obtaining his supply in consequence of their boring operations. After the passing of the Act, the water supplied by the Company is not, except in case of accident or breakdown, or with the consent of the Local Authority, to exceed 12° of hardness according to Clark's scale. Authority is given for any urban or rural district council whose district is wholly or in part within the Company's limits to guarantee payment to them of the cost of laying down any pipes for the supply of water in the district. Water for carriage or motor washing or for stable purposes is to be charged for at a rate not exceeding 20s. per annum. The Company may raise additional capital to the amount of £40,000, inclusive of premiums; and it will carry 7 or 5 per cent. according as it is issued as ordinary or preference capital. The latter is not to exceed £20,000. Power to borrow to the extent of one-fourth of the new capital, and to create debenture stock, is given. The Directors are authorized to appoint a Managing-Director and to determine the Secretary's remuneration. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

Authority is given to the Southend Water Company to raise additional capital to an amount not exceeding £250,000 by the issue of new shares or stock, create and issue debenture stock, and borrow to the extent of one-third of the new capital raised at the time of borrowing. The Company are not to raise or borrow any money during the continuance of the present war, and twelve months thereafter, without the previous consent of the Treasury. The dividend on the additional capital, whether issued as ordinary or as preference, is limited to 5 per cent. The Company propose to construct seven pumping-stations, to be situated in the parishes of Hockley, South Fambridge, Canewdon, Paglesham, and Canvey Island, and a tunnel in the parish of Fobbing; and they are granted fifteen years for their completion. As in the Frimley and Farnborough case, authority is given to any urban or rural district council whose district is wholly or in part within the Company's limits to guarantee payment to them of the cost of laying down pipes to supply water in the district. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The South Staffordshire Water Act confers upon the South Staffordshire Water-Works Company power to extend their limits of supply so as to include a number of parishes in the rural district of Cannock, in the county of Stafford; also to construct new works, consisting of two wells and pumping-stations in the parish of Brewood, and two pipe-lines in connection therewith. Seven years are granted for their completion. Additional capital to the amount of £150,000 (including premiums) may be raised, the dividend on which is to be 7 or 5 per cent. per annum according as it is issued as ordinary or preference. Power is given to borrow to the extent of one-third of the new capital, and to create debenture stock. In the case of water supplied for domestic purposes being used in stables by means of a hose-pipe, the Company are authorized to charge any additional sum not exceeding 20s. per annum. The Act contains a large number of protective provisions applicable to certain specified bodies and to owners of existing wells affected by the Company's pumping operations. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

In the Bill promoted by the Sutton District Water Company they sought authority to construct additional works, consisting of a well or wells and pumping-station in the parish of Cheam, in the rural district of Epsom, and a conduit or pipe-line connecting it with a service reservoir to be built in the same parish. Capital was applied for to the amount of £250,000, including premium, with the usual power to borrow to the extend of one-third. The Company, however, abandoned their scheme for new works, and reduced to £180,000 the amount of additional capital they applied for. The Act consequently contains this figure, with the customary borrowing powers; but the Company are not to raise or borrow

money during the continuance of the present war and twelve months afterwards without the previous consent of the Treasury. [*Parliamentary Agent: Mr. J. Kennedy.*]

The Weardale and Consett Water Act empowers the Water Company to construct additional works of an extensive character. The powers conferred by the Weardale Act of 1902 to make and maintain the Burnhope reservoir, and aqueduct terminating therein, a tramroad, as well as a road diversion, all in the parish of Stanhope, in the rural district of Weardale, in the county of Durham, are revived; and additional powers are granted for the construction of three intakes, &c. For the completion of certain of the new works specified, the Company have been granted fifteen years, and with regard to the other works five years, from the passing of the Act. The existing capital is to be applied to the purposes of the Act; but section 55 of the Act of 1902, relating to the raising of additional capital, is amended by the reduction of the amount specified therein from £840,000 to £440,000; and the Company are restricted to six years for the payment of any back-dividends. The Act contains the provision already referred to restricting the raising of money during the war. From and after the quarter-day which shall next happen after the Company have obtained from the Board of Trade a certificate that they have expended not less than £120,000 on the new works authorized by the Act and the necessary lands therefor and for the works in respect of which the powers are revived and the costs of the Act, or some of such purposes, the Company may charge for a supply of water for domestic purposes the following rates, in lieu of those now in force: Where the rateable value of the house, or part of it, does not exceed £7, the sum of 12s. per annum; where it is above £7, the rate of 10 per cent. per annum of the rateable value—in each case with extras for an additional closet and a bath. When £200,000 have been expended on the Burnhope reservoir, the Company are to allow a rebate of 10 per cent. on the above-mentioned rates for water, and 5 per cent. when it has been completed. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The West Gloucestershire Water Company have obtained legislative sanction for the amendment of the borrowing powers they possess under their Acts, so as to limit the amount to one-third of the capital raised at the time of borrowing, and for authority to raise on mortgage or by the issue of debenture stock such sums as, with the aggregate amount raised at the date of the passing of the Act, will make £86,666 in all. The Act contains the usual provision restricting the raising of any money during the war. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

THE PRODUCTION AND RECOVERY OF TOLUENE FROM ILLUMINATING GAS.

By a Gas Engineer.

In the "Journal" for the 7th inst., pp. 502-3, appears a very interesting article on the above subject, from the point of view of the coke-oven expert. But the urgent need of toluene for the manufacture of explosives is at the present time taxing also the ingenuity of all engineers of coal-gas works.

The removal of the benzol series of hydrocarbons from the gas raises those dread spectres, "Low calorific value, naphthalene trouble, and consequent possible loss of consumers." This question is therefore of the greatest importance, and presents the following problems:—

1. The quantity of benzene which must be left in the gas to give it the necessary calorific value and illuminating power for the particular district and to prevent the deposit of naphthalene.
2. The possibility of increasing the hydrocarbons in the gas without a decrease in the volume of gas made per ton of coal carbonized.
3. The best and most suitable method of recovery of the toluene which allows the benzene vapours to remain in the gas.

As to (1), many modern works, with high temperature and consequent high yields, strip their coals and partially decompose the hydrocarbons in the gas, and therefore, unless the temperature of carbonization is reduced, there is no margin of hydrocarbons in the gas for washing.

As to (2), in ordinary methods of carbonization, to increase the yield of toluene, either a lower temperature, with a consequent decrease in the volume of gas made, or the purchase of a better class of coal is necessary. Recent experiments have shown that it is possible by the use of a catalyst during carbonization to considerably increase the volume of hydrocarbons in the gas, and also to increase the volume of gas made per ton of coal carbonized. This method provides a margin of toluene in the gas for washing without loss in calorific value.

As to (3), numerous suggestions have been made relating to the washing of the gases by creosote and tar. In considering this problem, the capacities of the respective plants and conditions of working must be taken into account; also the capacity of the washing medium for absorbing the product required to be recovered from the gas.

In modern coking practice a carbonizing capacity of approximately 40,000 tons per annum is supposed to be the minimum at which a benzol-recovery plant is profitable. Of about 1600 coal-gas works in the United Kingdom, it is estimated that the greater number carbonize from 1000 to 10,000 tons per annum.

The conditions of working between coke-oven and gas-works plants are totally different. The primary object of the coke-oven engineer is to make coke. The illuminating power of the gas made is of no consequence to him; and the average calorific value is much lower than that of coal-gas works. The coal-gas engineer has to work to standards in calorific value and illuminating power, and to distribute gas of the specified standard over large areas.

With plants working under coke-oven conditions there is not the slightest doubt but that creosote is the ideal medium for washing—this being proved by its almost universal use in these plants. The case is quite different in coal-gas works, where a much less quantity of coals per day are carbonized, and where the slightest deficiency in illuminating power, or the expenditure of new capital, has to be seriously considered.

Taking a works carbonizing 10,000 tons per annum, we may examine:

1. The relative advantages of the different methods of washing.
2. Proposals for increasing the percentage of toluene in the gas and tar as applied to coal-gas works.

Creosote Washing.

As to the advantages. Washing with creosote presents a possible yield of 3 lbs. of toluene per ton of coal carbonized, by reason of the gas being totally stripped of the benzol series. The disadvantages of creosote washing are: (*a*) Owing to the large quantity required, approximately 2000 gallons, it would be necessary to put up a complete plant to debenzolize the washing oil, in addition to the washing and fractionation of the benzols recovered. The cost of such plant would be about £2000. It is very doubtful if the makers would guarantee that a plant of this size would pay its working costs. (*b*) The calorific value of the gas would be reduced by 8 per cent., and the illuminating standard reduced to 9 candles. (*c*) The naphthalene difficulty would be considerable.

Washing by the "C" Process.

The advantages are: (*a*) The tar for washing, receiving, and storage tanks, and washing apparatus are in most cases already on the works, requiring little or no capital outlay to put into operation. (*b*) The gas can be washed to meet the calorific value and illuminating power required for the particular district. (*c*) The tar required for washing is much less in quantity, owing to its higher specific gravity, and consequent greater affinity for oils of the higher boiling points. (*d*) The cost on capital account and in working the process is practically *nil*. (*e*) It is equally efficient at works of any capacity, from the smallest to the largest.

The disadvantages are: (*a*) The percentage of toluene recovered is lower, owing to the partial combination of the toluene with the tar. (*b*) Deposit of naphthalene in the mains. This may, however, be avoided by removing the toluene fraction, and allowing the light benzols to pass along with the gases during washing.

The losses of toluene due to its partial combination with the tar can be overcome by the use during the process of carbonization of the coal of a catalyst which causes the production of a tar of a different composition, more fluid in character, and which does not retain so large a percentage of the hydrocarbon oils.

We may, therefore, concede that while creosote is specially suitable for coke-oven practice, yet for most coal-gas works it is commercially impossible, and does not possess sufficient attraction to gas engineers.

They, however, have not been idle on the question of increasing the percentage of toluene in the gas and tar, and numerous proposals with this end in view have been tried at many works with varying degrees of success. Professor Leo Vignon has shown by his researches on carbonization of coal that carbon monoxide reacts with lime under certain conditions, forming hydrocarbons and carbon dioxide, and that the methane present in small proportions in water gas owes its presence to the catalytic action of lime contained in the coke.

Catalytic Properties in General.

The part which a catalyst plays during the reactions is shrouded in mystery. A catalytic agent according to Berzelius is a substance which merely by its presence, and not through its affinity, has the power to render active affinities which are latent at ordinary temperatures.

The following, however, are generally recognized "articles of faith": 1. The catalyst has the same chemical composition at the beginning as at the end of the reaction. 2. A small quantity of the catalytic agent is sufficient to effect the transformation of an indefinitely large quantity of reacting substances. 3. The activity of the catalytic agent depends on its physical condition; the finer its state of division, the greater will be its chemical activity. 4. The catalyst is not in the same physical state after the reaction is over. 5. The catalytic agency takes place in the presence of water vapour; the latter acts the part of a carrier. 6. A catalytic agent is not capable of starting a reaction; it can only modify the velocity of the reaction.

The advantages of limestone as a catalytic agent are: 1. Its capacity for absorbing heat under certain conditions, and decomposing at a low temperature into nascent calcium oxide and carbon dioxide. 2. The calcium oxide, upon being freed from its

neutralizing agent, is much more chemically active than caustic lime, and attacks and decomposes the organic matters and bases contained in the coal, thus splitting-up and liberating the primary products of carbonization at an earlier period of carbonization. 3. The calcium, being in a pure finely-divided state, possesses all the known properties of a good catalyst, which by its reactions assist according to their affinities the combination of oxygen and hydrogen, forming water, and hydrogen and carbon forming hydrocarbons. 4. The calcium, after its chemical and catalytic properties have been utilized, combines with a portion of the sulphur liberated by the decomposition of the iron sulphide and the ash-forming materials fluxing with them at a lower temperature, and produces a more fluid slag, which binds the carbon into a firm hard coke.

The "Synthetic" process, in which limestone is used as a catalyst in the carbonization of coal, possesses great possibilities, and lends itself specially to the "C" process of washing at coal-gas works. The toluene content in the gas and tar is greatly increased, and other commercial and working advantages have been noted during a period of three months at a medium-sized modern works using this process.

Gas.—An increase in the quantity of gas made per ton of coal. An increase in the calorific value of the gas. A sensible decrease in the quantity of sulphur compounds. Less deposit of naphthalene in the services. Less deposit of graphitic carbon on the inside of the retorts.

Tar.—A much more liquid tar, containing a greater quantity of the higher aromatic hydrocarbons. No pitched hydraulic mains, and comparative freedom from blocked ascension pipes.

Coke.—An increased yield of larger saleable coke, consequently a decreased quantity of breeze. The quality of the coke is very much improved.

Ammonia.—A sensible increase in quantity.

Toluene.—The quantity of toluene recovered from the tar after washing the gases was increased over fourfold.

[In next week's issue we may have some definite particulars for publication relating to the "Synthetic" process referred to in the above article. Meanwhile attention may be specially directed to a reference to the matter in the editorial columns. —Ed. J.G.L.]

THE GAS-FITTER—WANTED A DEFINITION.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

One of the standing difficulties that has always beset the Council of the Institution of Gas Engineers is the heterogeneous character of its members, who are gathered from every grade of society—from the labouring class to the plutocrat. At one end of the scale there is the manager of a village gas-works, who may possibly have entered the service of the company whose affairs he now superintends, as a yardman, or stoker, and gradually worked his way up. He has seen very little of the gas industry outside his own sphere, and never enjoyed the advantages of technical education in any form, as unless within easy hailing distance of some educational centre—such as London, Manchester, Birmingham, &c.—the small man might just as well be in the Colonies so far as opportunities for attending good evening classes are concerned. But he is a regular student of current technical literature, and has collected by degrees a small technical library; while the fact of having acquired it by careful saving and scraping, ensures a more thorough usage than is sometimes the case with owners of an extensive library collected by the exertions of others. His ideas are naturally somewhat cramped, because he rarely has the opportunity of visiting other gas-works or associating with other managers. At the other extreme, we have the engineer and manager of a gas-works of the first magnitude who has received the highest technical instruction that the educational resources of the country can supply, followed by pupilage under a leading authority, and is probably familiar with all the large and important modern gas-works, not only in England, but in Europe. These extremes are not separated by any sharp dividing line, but by all sorts of graduations as between one and the other. Many of the members have sufficient training and experience as civil engineers to discharge the duties of engineer and manager in the fullest sense of the word. Others are managers only, or perhaps more in the way of a superintending accountant; the technical part being cared for by a consulting engineer. There is a great divergency between the duties respectively discharged by the manager and the secretary, or by a technical managing director. The roll of members comprises, therefore, a motley assemblage, having very little in common in respect to technical and commercial ideals, education, habits of life, and so on. It is no wonder then that the Council find it impossible to please everybody.

Similar lack of homogeneity applies to the gas-fitter, as he is generally understood. The word does not cover so wide a range in the social sense; but it comprises many different varieties of training, environment, education, and ideals. The older men have had no technical education other than the traditions of the trade, as acquired by acting as fitters' mate. The younger, with the reservation above referred to, have been able to attend technical institutions fitted with laboratories and workshops. So much is written and said about the desirability of improving the gas-fitter that it is scarcely possible to find a number of a current gas magazine that is free from some reference to the subject. While there is general agreement as to the necessity, or at least the desirability, of improvement in sympathy with the increased call on the gas-fitters' tact and technical ability, brought about by the multiplication and refinement of appliances for consuming gas, there is no uniformity as to the status and present position, or the precise direction that the lines of improvement should follow. There is too much use of general terms—such as improvement, better education, &c.—to which scarcely any two persons attach exactly the same meaning, and not enough clear reasoning as to the components of a competent gas-fitter. Nebulous and indefinite ideas as to the improvement of the gas-works manager were in existence for at least a quarter of a century before the thing took concrete shape; and until something is done in the way of a definite curriculum and classification of the duties—for there is quite as much difference between house carcassing and complaints as between gas manufacture and distribution—the workers in this important cause of elevating the gas-fitter will labour under much disadvantage.

A speaker at a gathering of gas engineers, having occasion to refer to the gas-fitter, naturally has in view the characteristics of the particular individuals of the class with whom he is immediately associated; as even if he does not follow the general practice of undertaking all kinds of gas-fitting work, he must have the services of a fitter to attend to the fixing and removal of apparatus on hire and to complaints. But in a large works the manager himself does not come into daily contact with the workers in the fitters' department, which is placed under a special superintendent. In other respects the position of the fitter varies according to the size of the undertaking. In a small town one man may be able to do the whole gas-fitting, apparatus on hire, and meters; and he probably is left to a great extent "on his own"—the only supervision being that exercised by the secretary or manager, who possesses nothing more than a general knowledge of the practical details. Work of especial importance excepted, the fitter will probably be expected to see the job through from first to last, including taking instructions, getting out estimates, deciding sizes of pipes and description of gas-fittings, laying-out the job, and measuring-up after completion.

It is under these circumstances, perhaps, that the need for a man of good education and address is more evident than in a larger town where a large staff of fitters are employed, as the greater part of the work above alluded to, other than the mechanical execution, is arranged by a practical superintendent and his assistants, or covered by fixed rules. The gas-fitter may well be a smarter and neater workman under these circumstances, but he need not be qualified to act as a district inspector. The same applies to repairs and complaints. In the small town, the fitter is expected to tackle and remedy all troubles single-handed; but in the large district these matters are under the control of special officers. One great drawback in regard to small districts, speaking, of course, in a general way only, is that the directorate are apt to cover their technical deficiencies by a rigid and unreasonable economy in respect to wages. In the larger works there is more willingness to pay a rate of wage proportioned to the skill and ability of the recipient; but the small directorate has not yet grasped the fact that, if their business is to be developed to the best advantage, they require the service of a gas-fitter who is worth something more than the local rate of wage. It is evident that at least two different sets or courses of study, examinations, and certificates, are necessary to cover the whole of these requirements. A gas-fitter may specialize in new work or in complaints and repairs, or in both if so disposed. It would seem that the day is rapidly approaching when his work might with advantage be further divided, and he might specialize in one department only—such as cooking, gas-fires, engines, water-heating, &c.

The subject is not complete if we omit the consumers' definition of a gas-fitter. In the small district the gas-fitter is, or should be, regarded as a guide, philosopher, and friend in regard to all matters connected with the consumption of gas. But even in the largest districts, there is an impression among the consumers that one is more likely to get disinterested advice from the workman than from the canvasser or inspector, who is supposed to be directly interested in making a big job. The fitter is closely cross-examined in respect to complaints of overcharge, &c., or by the user of a set of fittings that have been in existence for the last fifty years, and also were not properly set out in the first place, with a view to eliciting some statement that will support the theory that it is not the consumer's fittings that are at fault, but the mains, the pressure at the works, or anything in the world that does not touch the consumer's pocket. The fitter is also questioned as to the economy or otherwise of cookers, fires, engines, and other apparatus. It would be a help to the management to obtain an authentic list of the questions addressed to a gas-fitter in full employment (say) in the course of a month. During discussions with customers, how often the gas manager or salesman finds that the consumer's opinions have been greatly biassed by information received "from one of your men," and that the same anonymous individual is prepared to certify that the customer "could not possibly have used so much gas." No amount of technical education will compensate for lack of tact and good address on the part of the gas-fitter, who should never under any circumstances indulge in criticism of the management, or draw on his imagination for answers to questions that are really outside his department.

GERMAN HYGIENE APPLIED TO GAS.

A CRITICISM OF PROFESSOR M. VON GRUBER'S WORK.

By W. J. A. Butterfield, F.I.C., Assoc.Inst.C.E.

(*Concluded from p.* 569.)

The Analytical Methods Employed.

Professor von Gruber states that the greater number of the determinations of carbonic acid in the air of the rooms which were carried out in the course of the research were made with Dr. Haldane's apparatus, to the convenience and accuracy of which he bears testimony. There is, however, an opportune confirmation of the writer's earlier comments on the German professors' lack of knowledge of external researches and analytical methods in the statement of Professor von Gruber that he believes that the research which he describes affords the first instance of the use of this apparatus on a considerable scale in Germany. Since the apparatus in question was described fully, and its convenience and accuracy demonstrated, in the Blue-Book on the Ventilation of Factories and Workshops which was issued in 1902, and in the following year in the "Journal of Hygiene"—a journal with which presumably a Professor of Hygiene would be well acquainted—while particulars showing the extensive use which had been made of it up to 1909 were given by the writer in the "Analyst" of that year, it certainly is a little surprising that only now has it received recognition in Germany, though admittedly there is no other apparatus in use there which serves the same purpose. It was employed by Dr. Samuel Rideal in the series of investigations on the "Relative Hygienic Values of Gas and Electric Light" on which he reported in 1908 [see "Journal," Vol. CI., pp. 613, 686], which investigations had the same object as the present series by Professor von Gruber. It would almost seem, however, that Professor von Gruber was ignorant of Dr. Rideal's work, since he does not refer to it, and writes as though he were not aware that an investigation more exhaustive than his own had already been carried out. Nevertheless, Dr. Rideal's researches were described by him in great detail in the "Journal of the Royal Sanitary Institute"—another journal with which a Professor of Hygiene would presumably be familiar. In no particular, in the writer's view, were Professor von Gruber's researches as well conceived and as well carried through as Dr. Rideal's, while his inferences and deductions can almost all be challenged as unsupported by the results obtained; whereas Dr. Rideal's scientific instinct and good judgment prevented him drawing any deduction which could not be fully sustained.

Apropos of Professor von Gruber's analytical work, in several instances a determination of the oxygen content of the highly-fouled air which he had from time to time in his experimental rooms would have thrown useful light upon the other results of the observations. He does not, however, report any determinations of the oxygen content of the air. Perhaps he made none, because he may not have been aware of the rapidity and ease with which these determinations can be made by Haldane's apparatus for the analysis of mine air. A series of such determinations of oxygen in the air of a chamber of which the ventilation was at times purposely restricted were made by Haldane, Trotter, and the writer in the course of researches on the effect of variations in atmospheric conditions on the light of flames [*vide* "Journal," Vol. CXV., p. 288]. No difficulty was experienced in making these determinations rapidly *in situ*, though if Professor von Gruber had found any difficulty in doing likewise he could readily have taken samples of the air for subsequent analysis. Certainly Professor von Gruber is rash in assuming that the determination of carbonic acid in the air is sufficient guide to its influence on the ventilation and lighting of rooms, if in some cases the carbonic acid is added from a bottle of the compressed gas, in others formed by the combustion of coal gas, and in others produced by breathing. Variations in the oxygen content of the air are of greater significance than variations in the content of carbonic acid except in the effect of the changed composition on beings breathing the air. In regard to human beings, it has been well established by physiological researches that any proportion less than 100 volumes of carbonic acid per 10,000 is of no importance in air at ordinary pressure, provided no other harmful impurity is present. If the breathing is not increased by heavy muscular work, a much higher proportion of carbonic acid in the air causes a scarcely noticeable subjective effect. In the researches on the light of flames already referred to, the writer found that even 250 volumes of carbonic acid per 10,000 of air caused him no discomfort.

Effect of Carbonic Acid on the Volume of Air Breathed.

It may be pointed out that Professor von Gruber apparently spent a good deal of time in proving a fact which has been well known for some years to physiologists (in England at least). The results of the series of tests reported by him in Table II. [*ante*, p. 451] show that the volume of air breathed by the human being increases with the proportion of carbonic acid in the air inhaled—other conditions being unaltered. This fact will be found stated in modern English text-books on physiology; and had he and his colleagues been as well informed as they should have been before undertaking a research of this kind, they would not have wasted time on furnishing indifferent proofs of an already well-known physiological fact. In English works on physiology clear statements, based on experimental data, such as the following from Dr. Haldane's writings, occur:

> "If carbonic acid is present in the air inspired, the effect is to make the breathing deeper, and finally also more frequent."

And, again:

> "The breathing is, in fact, so regulated as to maintain a constant percentage of carbonic acid, 5·6 per cent. on an average, in the alveolar air. If the production of carbonic acid in the body increases, as during muscular work, the breathing at once increases sufficiently to keep the alveolar carbonic acid percentage almost constant. If carbonic acid is present in the inspired air, a similar effect is produced. Thus if 2·8 per cent. of carbonic acid were present in the inspired air, the breathing would be nearly doubled; since it would take twice as much of the inspired air to keep the alveolar carbonic acid percentage at about 5·6 per cent.

Apparently, however, Professor von Gruber and his physiological colleague were unaware of these facts, and started on, to them, quite novel experimental ground, in order to ascertain them. They did all this, too, merely to confute a German "authority," who was even more ignorant of the physiology of respiration than themselves.

Fundamental Faults in Von Gruber's Research.

Apart from his want of knowledge of the work of other investigators, and his failure to interpret properly the results of his own work, Professor von Gruber committed some very serious errors of judgment in the selection of the experimental rooms and in the general arrangements for the comparative tests. The rooms purported to be typical of those which would be occupied by members of the less well-to-do classes; but even in Germany—a country where size of rooms counts for more than their number—rooms 20 feet in length can hardly be regarded as fulfilling this condition. The room had only one window—at one end—the frame overall measuring about 4 feet by 6 feet. It seems probable from the drawings that this was a double window. With only one door, at the opposite end of the room, and with a close oak flooring, doubtless waxed and polished, it is not surprising that the ventilation of the room, with window and door closed, was negligible. We are not told anything about the ceiling; but a covering of varnished paper would be in keeping with the style and class of room. The writer cannot agree that this room is typical of those occupied by the less well-to-do classes, even in Southern Germany; and when Professor von Gruber asserts that his researches made in it show that Pettenkofer had much over-estimated the natural ventilation of ordinary living-rooms, he is in reality passing condemnation on his own research. However this may be, investigations made in such a room are practically valueless for throwing light on the hygienic aspects of gas lighting in the living-rooms of the less well-to-do classes in Great Britain.

Suggestion for a Conclusive Investigation in English Conditions.

It is, however, not improbable that some of Professor von Gruber's conclusions may be quoted in this country by persons who do not know how little weight really attaches to them, and that gas lighting may thereby be deemed to be less good hygienically than it really is. It is highly desirable in the interests of the public that the gas industry should take immediate steps to counteract any such wrongful aspersions on gas lighting. Many lectures by Professor Vivian B. Lewes—who is a striking exception to the rather sweeping charge which the writer, with Germany foremost in his mind, earlier levelled against professors as consultants—supply data and facts which might be quoted again with great advantage. Then Dr. Samuel Rideal's research (reported on in 1908) provided a mass of information which somehow appears to have escaped proper utilization by the gas industry. But it may reasonably be argued that the room used by Dr. Rideal was scarcely representative of the average living-room, and in a few respects his investigations were admittedly uncompleted. The publication of the account of Professor von Gruber's work, which was undertaken on behalf of the German Association of Gas and Water Engineers, suggests that the British Commercial Gas Association, or the Institution of Gas Engineers, or other appropriate body, should take steps to have a series of authoritative and conclusive investigations made on the hygienic aspects of gas lighting in average living-room conditions in this country. A full account of the investigations must be published, in order that possibly hostile criticism may be forestalled; but it is of paramount importance that the rooms used and their equipment, occupancy, &c., should be fairly representative of living-room conditions with the less well-to-do classes in this country. Further, the conclusions should be drawn from the data obtained without bias or reservation, but these conclusions should all be summarized in pithy, straightforward language, which will rivet

the attention of people who have no special acquaintance with technical or medical terms.

The writer, in conclusion, ventures to suggest the style of room which seems to him fairly representative. This is the ground floor sitting-room of the modern suburban cottage, of a rental value of £25 to £40 a year, according as it may be in the Provinces or in the London suburbs. It will usually have a small bay window, and, of course, a fire-place, and will be about 10 feet square. Two such rooms should be used, in adjacent and symmetrically disposed cottages—either a pair of semi-detached, or two adjoining cottages in a terrace. Both should be fitted with a simple modern inverted gas-burner of appropriate size, and with a modern metallic filament electric lamp. Every trial should be made in duplicate simultaneously, the only difference being that when one room is lighted by gas the other is lighted by electricity. Further, each trial—with very few exceptions—should be repeated next day, merely reversing the mode of lighting the rooms. In this way the effects of otherwise uncontrollable differences of location or environment, which cannot always be foreseen, can be eliminated. The rooms should be decorated and furnished according to their class, but identically, and the decoration should not be new—rooms which have been in careful occupation for about a twelvemonth might well be chosen. The back rooms and passages should be available for the observers, and it would be a great advantage if a door were provided giving direct access from the back room of one cottage to the back room of the other. There are many other points—such as the heating of the rooms, which must be considered without bias, for an attempt to combine an investigation of the hygienic aspects of different modes of lighting with one of different ways of heating would probably end in inconclusive results being obtained in both branches of investigation. The investigations, even in the hands of consultants thoroughly familiar with the class of observations required, could hardly be completed satisfactorily in less than a twelvemonth. The work, however, ought to prove of great ultimate benefit to the public. The writer believes the gas industry should gain much from it, and has absolutely nothing to fear from competent investigators, whether briefed by it or by a public or state authority.

THE MONO-RAIL TELPHER.

ITS INSTALLATION, CARE, AND MAINTENANCE.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

(*Concluded from p.* 502.)

Repairs to Motors.

In view of the fact that the mono-rail telpher as manufactured by Messrs. Strachan and Henshaw readily lends itself to the removal of both the travelling and the hoisting motors, the writer has no hesitation in declaring that no really serious repair or overhaul can be effected on these motors *in situ*. It is his experience that the time and labour incurred in the removal of the motors bodily from the machine to the electrical repair shop are more than saved by the greater rapidity with which the necessary repairs can be effected there and the more satisfactory nature of the job.

Where it is necessary to remove an armature, for instance, the greatest care is necessary in the withdrawal of it in order to ensure that the conductors and the commutator are not injured, and under none, save the most unusual conditions, should this be undertaken on the machine. The motor itself is a robust machine, and can be handled to a certain extent roughly in being swung out and lifted back into position. To put it plainly, it is, as a whole, admirably adapted to withstand the rather rough-and-ready methods of the average gas-works handy man; but its component parts, to which so much injury can be done with a minimum of carelessness should never be entrusted to the handling of this individual.

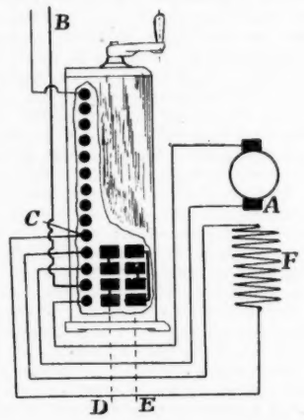
With a telpher plant constantly in use, the machines should be laid-off for a couple of days every eight or nine months, and the motors removed to the electrical repair shop and taken adrift. Bearings should be tested for clearance and replaced if necessary; while if spare armatures are kept, it will be wise to run them alternately. On some telphers the motors are mechanically and electrically interchangeable; and it is only necessary to keep one spare armature. On the plant under the writer's care, the two motors have run for three years with no other repair than a periodical overhaul and the changing of an armature.

The "C" type of Siemens' motors supplied with Strachan and Henshaw's telpher plants have four bushed holes at their sides through which the armature and field conductors pass; and it is invariably these conductors that suffer if the motor is handled roughly in slinging out. To do away with this possibility, these holes can be plugged up and four ¾-inch holes drilled through the top of the motor carcase between the end shield and the brush gear. These holes can be bushed and fitted with four terminals passing through the insulated bushing, and connected inside the motor to their respective points by strip copper connections. On the plant at the Plymouth and Stonehouse Gas-Works this small alteration has given the greatest immunity from trouble of this sort, and has also been carried out on the Fiddes-Aldridge machine motors. Fig. 10 [*ante*, p. 575] showed the inverted selenoid brake of the hoist motor; it also gave a view of the terminals with the cables and thimbles connected.

Telpher Wiring.

The wiring of the machine should be maintained in an efficient condition and be carefully inspected from time to time, in order to detect any weak places where the insulation has been frayed or perished. Faults from this cause should be comparatively rare if the work has been carried out in a proper manner. No wires should be allowed to lie about loose on the machine, but the whole of the motor, controller, and resistance leads should be encased in a substantial steel conduit carried as close to the various appliances as is possible.

The wiring diagram in fig. 7 [*ante*, p. 573] may appear complicated at first, and a little explanation may not be out of place. The connection of a series motor to a reversing controller is a comparatively simple matter. It is shown in fig. 11, from which it will be seen that the current passes from the last resistance terminal to the field terminal on the motor, and then through the field windings back to the controller, whence it is sent out through the armature in a direction according to the rotation desired. The reversal of a series wound motor is carried out by reversing the direction of the current through either the field coils or the armature—not, be it noted, by reversing the flow of current in both.



A. Armature. B. Supply Mains. C. Last Resistance Terminal. D. Reverse. E. Forward. F. Field.

Fig. 11.

When a second motor has to be operated from the same controller, it becomes necessary to use a change-over switch, which will disconnect one motor from the controller and make connection with the second machine. Seeing that there are four wires connecting a series motor to a reversing controller, it would appear at the first consideration that a four point or pole double-throw switch was necessary. In practice, however, it is only necessary to break one armature and one field connection, and so a double pole two-way switch is all that is necessary; and this is exactly what the special change-over switch is. It is simply a directional switch, and, having been set to the direction in which it is desired to send the current, ensures that the field and the armature leads from the controller are connected to the armature and the field windings of the particular motor which it is desired to operate. If the wiring diagram be studied in an intelligent manner, and the elementary function of the switch borne in mind, any idea that the wiring is complicated will speedily disappear.

Fuse Box *versus* Circuit Breaker.

In stating that a fuse-box alone on an electrical drive, particularly one in which the motor is a series-wound machine, is not a sufficient safeguard the author is guided by practical, and in many ways sad, experience. In previous articles he has dealt at length with this argument, but feels that no apology is necessary for a certain degree of repetition in connection with a point which has so vital a bearing upon the life and running costs of a plant.

The chief characteristic of a series motor is the heavy starting torque which it is capable of exercising, and which renders it an ideal machine for crane work, or, indeed, for any work the nature of which requires a heavy starting effort on the part of the motor. A motor and a dynamo possess dual characteristics, inasmuch as a motor when running generates an electromotive force in its windings which is in opposition to the impressed pressure at the motor terminals, and the greater this opposing pressure is the less current will flow through the motor windings.

The degree of this back electromotive force is regulated by the speed of the motor; so that it becomes apparent that the slower

the motor is running the lower will be the pressure which opposes the incoming current, and consequently the heavier will be the current flowing through the motor windings from the external supply. Proceeding, now, to apply this reasoning, we see that, on the occurrence of an overload, which, of course, causes the speed of the motor to drop, an increased current immediately flows through the motor windings, creating, in a motor of the type under consideration, a heavier magnetic field.

Among other factors, the torque which a motor is capable of exerting is proportional to the strength of its magnetic field; and the heavy torque or driving effect which a slowing-up series motor possesses can easily attain such proportions as may result in serious damage, not so much to the motor as to the gearing of the machine to which it is coupled.

Theory teaches us that this is exactly the state of affairs which a fuse-box is designed to prevent; but a moment's consideration will show that a fuse cannot blow instantaneously, in the true sense of the word. It has to reach melting temperature; and in the short time which must elapse between the hanging-up of the motor and the blowing of the fuse almost any damage may result. A fuse is a circuit-breaker with a thermal time limit which will effectually limit the duration of an overload, but which is utterly incapable of preventing the heavy torque which a series motor must exert when something "binds," and which can, and does, cause a smash.

Another valuable argument in favour of the circuit-breaker is the time it saves. Even assuming that a fuse was an instantaneous device, and could be relied upon to open a circuit synchronously with the occurrence of an overload, it must be remembered that a blown fuse will take at least one minute to replace, while a circuit breaker can be reset by one stroke of the operator's hand. The writer's experience shows that the fuse-box should be supplemented by the installation on one pole of the system of an automatic magnetic circuit-breaker of the type used on our street-car undertakings; and this breaker should be tripped daily by hand, so as to ensure that it is in working order. Where electric stoking machinery is installed, this breaker may be of the same size and type as used on that plant, so as to further standardize.

It may be mentioned that in the installation of Fiddes-Aldridge machines under the writer's care the circuit-breakers play a large part in the low maintenance charges of the installation. The failure of a circuit-breaker is invariably followed by the breakage in the gear of one or other of the motions; and the greatest care is taken to keep the breakers in the best possible order. The load on the motors of these machines is a very "dead" one; that on the telpher motors is much more "lively;" while in the case of the latter installation the liability to breakdowns from the cause outlined above is certainly more remote. The installation of a good circuit-breaker, however, may be looked upon in the light of a good investment, and will pay for itself many times over by the protection which it will afford to the mechanical as well as to the electrical equipment of the machine.

A Mysterious Fault.

The following description of a fault which occurred on the plant under the writer's charge, and which is liable to crop up on any plant working under similar conditions, and by its mysterious nature to cause considerable delay, may be of some interest. The telpher plant at the Plymouth and Stonehouse Gas Company's works is situated in the No. 1 retort-house coal-store, and comprises an endless track running the entire circuit of the store. The length of this track is 510 feet; while the radius of the end loops is 18 feet and the height of the track from the ground is 30 feet. A photograph of this track, with the telpher, is shown in fig. 12.

Running centrally above this track for the entire length of the store, and at a height of 35 feet above the ground, or 5 feet above the telpher track, is a large band coal-conveyor, which distributes the coal elevated on to it at one end of the house to any desired place in the store. When large stocks of coal are being stored,

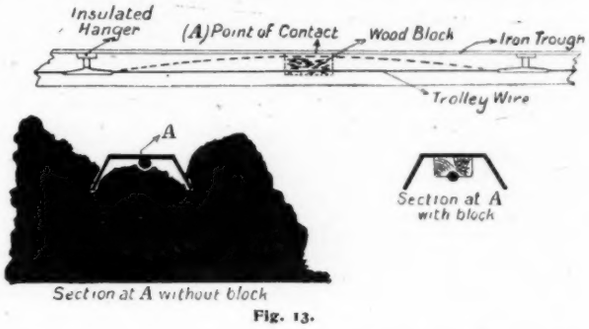


Fig. 13.

portions of the telpher track are completely buried in; and in order to protect the trolley wire from injury an inverted iron trough, as shown in fig. 13, is fitted above the wire for the entire length of the track.

About three years ago, a mysterous fault developed on the telpher circuit. The coal-store, being fairly full, the three equidistant elevator boots usually fed by the telpher grab were covered by stocks of coal. Consequently for several days there had been no occasion to use the machine, and the trolley wire circuit had been dropped at the main distribution switchboard

FIG. 12.—TELPHER TRACK AT THE PLYMOUTH GAS-WORKS.

When the telpher was required again, it was found upon switching in, that a bad fault existed on this circuit, and a test with a megger revealed a dead "earth." The removal of the telpher collector from the trolley wire did not clear the fault, which was eventually traced to the trolley line itself; the insulation of the positive feeder from the generating station to the wire being perfectly sound. A large portion of the wire was completely covered up in the manner described, and a gang of men were set to work on top of the coal heap to clear the wire. Three dead "shorts" were discovered at different portions of the buried track; and a study of fig. 13 will make quite clear how the trouble arose.

As the coal had fallen from the hand conveyor it accumulated around, and finally buried-up the telpher trolley wires and, continuing to accumulate around and above the inverted trough, exercised a downward pressure upon that portion of the heap the top of which lay almost against the wires. With the increasing pressure this portion of the heap now began to find its way up into the inverted trough, and touched the trolley wire. All upward movement of the trolley wire was impossible at the points of suspension; but at the points of greatest sag—namely, at the centre of the spans between the suspension ears—the wire, with the coal forcing it, took an upward path until wire and coal were finally arrested by coming into contact with the roof of the iron trough. This fault is not an uncommon one under such conditions, and it is usually the case that the clearing away of the coal does not remove the fault from the line; the trolley wire being nearly always solidly fused to the iron trough just at the point of contact.

The remedy adopted at these works is to insert stout blocks of wood in the manner of distance-pieces at the centre of the spans between the wire and the trough as the heaps of coal are accumulating, and to remove them as soon as the stock grows low and it is desired to run the machine over this portion of the track. The presence of the wood blocks, as would also the presence of the coal in a more or less damp state, doubtless diminishes the insulation resistance of the trolley line; but in the 220-volt direct current installation under the writer's care this factor has never caused any trouble.

The trouble caused by this fault is not limited to the delay in clearing it, but may be further augmented by the fracture of the trolley wire at the point at which it has become burnt in the manner described. The trouble caused by the insertion and the withdrawal of the wood blocks, which are shown in the sketch, is trifling compared with the expense and delay occasioned when several tons of coal have to be removed by manual labour in order to discover a batch of faults.

Training of Operators.

The training of operators has a very important bearing upon the general efficiency of the plant, and small repair bills on any electrical plant can only be maintained provided the apparatus is in the hands of men who handle it in an intelligent manner. The author does not desire to repeat in this article much of what he has already written on this subject, and would refer all interested readers to an article in the "Journal" for April 14, 1914 (p. 120), on the "Care and Maintenance of the Fiddes-Aldridge Simultaneous Retort Charging-Discharging Machine," in which, under the heading of "The Training of Operators," he devoted some space to this all-important subject.

The bad or careless operator is a thorn in the side of the plant engineer, and is, unfortunately, too often listened to in his tale of woe in regard to his electrical equipment not working properly. Any statement on the part of the plant electrician, to the effect that the operator and not the machine is at fault, is often ridiculed or put down to "spite or incompetence" by the official or foreman to whom the statement is made—usually the last person to whom one would apply for a criticism on things electrical.

In this connection one or two plain facts should be grasped by the engineer who proposes to put down electrical plant. Unless he wishes to have enormous maintenance costs, and to be at the mercy of local electricians, he must engage a good man to look after it for him, and, having engaged him, he must place a reasonable amount of confidence in him and give him a reasonably free hand. No disputes should be permitted between the electrician and the plant attendants. The former either knows his work or he does not. If the latter, he should be fired before he puts the plant on the scrap heap; if the former, his word should be taken and no report on purely electrical matters should be recognized from anyone save the man paid to attend to such matters.

To a certain extent electrical principles have to become, on a gas-works, subservient to local conditions; and a good engineer will recognize this fact and will not attempt to keep the machines under his charge in the same spick and span condition as pertain in a central station. He will simply keep them in a really efficient state, and he should be helped in this endeavour and not hindered. The old axiom "A stitch in time saves nine" is strikingly applicable to electrical machinery; and when it is remembered what a bad breakdown of a large gas-works electrical plant will mean, the gas engineer should need no urging to do his best to keep his electrical plant in a thoroughly efficient condition.

Conclusion.

In placing these particulars before the readers of the "Journal," the author rather regrets that his notes on maintenance may not seem to be so comprehensive as, perhaps, would appear desirable. These notes embody largely his experience during the past four years with an installation by Messrs. Strachan and Henshaw, in respect to which the periodical system of inspection advocated has resulted in low maintenance costs, satisfactory running, and entire freedom from breakdown. He holds no brief, needless to say, for the speciality of this particular firm, and has written this article around the mono-rail machine as being, in his opinion, a sound-engineering proposition, and one which is certain to give the greatest degree of satisfaction under the severe conditions met with in gas-works plants.

In common with most engineers, his past experience with transporter plants has been a varied, and in many respects an unhappy, one; but in view of the rapid progress of engineering science, and the high degree of perfection to which the plant which forms the subject of this article has been brought in the past few years, it would be unfair to an excellent machine, as well as to prospective users, to give any recital of harrowing experiences with old, inefficient, and to a large degree experimental installations.

In conclusion, the author desires to express his appreciation to Messrs. Strachan and Henshaw for placing at his disposal some of the blocks with which this article is illustrated; and his thanks are also due to Mr. Percy S. Hoyte, the Chief Engineer of the Plymouth and Stonehouse Gaslight and Coke Company, for the courteous permission which has enabled him to place these notes before "Journal" readers.

GAS PRODUCERS FOR COLLIERY WORK.

Obtaining Power and Bye-Products from Unsaleable Fuel.

At last week's meeting of the Institution of Mining Engineers, a paper read by Mr. Mansfeldt H. Mills dealt with the question of whether the introduction of gas producers will reduce the cost of generating power in the getting of coal; while, at the same time (as the author remarked), the use of unsaleable fuel was an all-important matter not to be lost sight of.

Although the advantages of producer gas have been known for many years, he said, still its general use has not been adopted so universally as might have been expected; and it is only during the last few years that any significant advance has been made—doubtless due, in great measure, to the lack of sufficient information on the subject. A good deal has been written in various countries on producer gas and its uses; and as early as 1877 the writer wrote a short paper on the use of waste gas from coke-ovens at Bearpark Colliery, near Durham.

The history of the introduction of the gas producer shows how slowly some useful inventions have been adopted, even when it was clear that the more general use of gas as a motive power would have cleared the atmosphere of our large towns from the offensive smoke which still ruins the health of thousands of our people and disfigures the architecture of our cities.

As early as 1812, a patent was taken out by Mr. Aubertot for the utilization of waste gas for metallurgical operations. It is also said that an Austrian named Bischoff introduced a gas producer about the year 1839, which was internally fired with air-blast, but no steam. About 1849 the makers of the "Otto" gas-engine used a small suction gas producer; and in 1852 Kirkham invented the first gas producer in England, entirely fired from the inside with intermittent air and steam blast. It was not, however, until after 1861 that any considerable use was made of producer gas. About this time the late Sir William Siemens first used a gas producer for steel melting. The water under the fire-bars was vaporized by the heat of the fire—the steam passing up through the incandescent fuel in the producer. In 1876 Messrs. Brook and Wilson took out patents for a producer which formed the basis of future improvements; and in 1878, Mr. J. E. Dowson introduced a producer plant and induced Messrs. Crossley to try it with their gas-engine. But it was not until about 1882 that any real progress was made by them. In 1883 Messrs. Young and Beilby designed a producer with recovery of the sulphate of ammonia; and by 1885 the late Dr. Ludwig Mond had worked out great improvements which undoubtedly led to the more universal use of producer gas—especially from bituminous coals. In 1893 Dr. Ludwig Mond registered important patents which altered the original design of the producer from rectangular to circular; the whole shell being surrounded by a jacket through which the air passed on its way to the grate, thus further superheating the steam and air blast. Arrangements were also made for the recovery of bye-products. Later on Mr. E. J. Duff made some valuable improvements on the Mond process; and eventually the two amalgamated into the Power Gas Corporation.

With the introduction of the pressure-gas producer using bituminous coals, and with the various uses to which the gas came to be put, complicated methods of cooling, scrubbing, and washing the gas became necessary, and much ingenuity was exercised in designing various methods for getting rid of the tar in the gas, and in making the gas suitable for use in large gas-engines. Among those who may be mentioned as foremost in this pioneer work, as well as those already named, are Messrs. Dowson, Kerpely, Crossley, Wilson, and Lymer. And now, in the year 1915, the mining engineer can find a producer plant capable of dealing with almost any class of fuel containing upwards of 50 per cent.

of ash, which, under ordinary conditions of combustion, would cake and form hard clinker—in fact, fuel utterly valueless for any other purpose can now be gasified successfully.

Before giving the actual working results of various types of gas-producers, the writer made a few general remarks on the principles that govern their proper working, which he hoped might be useful to those who, so far, had not given much attention to the subject. He dealt specially with three different systems of generating producer gas—viz., the suction gas producer, the pressure gas producer, and the pressure gas producer with recovery of bye-products.

Suction Gas Producer.—In this plant anthracite, coke, and non-bituminous coals are generally used, although some suction gas producers are working on bituminous coal. The gas generated is used in a gas-engine, which is in direct connection with the producer without any intervening gasholder. Whether a four-cycle or a two-cycle gas-engine is used, the sucking action is the same. In the four-cycle engine the suction stroke of the piston in the cylinder opens the gas-inlet valve in the gas-main and draws in the required charge of gas, and, at the same time, draws into the producer a sufficient quantity of air for the combustion of the fuel. In the two-cycle engine an independent pump draws in the gas from the producer, discharges it into the working cylinder of the engine, and, at the same time, draws in the necessary air to the producer. Thus, it will be seen that in both cases the air supply to the producer depends upon the number of strokes of the engine; and in this way the combustion of the fuel is regulated to the requirements of the engine. This is the most simple form of gas producer, and where anthracite, coke breeze, or coke are abundant, and can be obtained at a low price, very economical power is generated.

Pressure Gas Producer.—At many collieries in this country it is necessary to use bituminous or semi-bituminous coal; and it has been found that the large amount of tar in the gas made from this class of coal clogged-up the valves of the gas-engines to such an extent that washers and scrubbers had to be interpolated between the producer and the gas-engine. This, in many cases, prevented the suction stroke of the gas-engine from being used for drawing in the necessary air to the producer for the combustion of the fuel; so that a fan is brought into action to force or draw the air through the charge of fuel. Hence the name "pressure" gas producer.

Pressure Gas Producer, with Recovery of Bye-Products.—All coal, he said, has a certain percentage of nitrogen in its composition, varying according to the class of coal. For the sake of illustration, a coal with 1·377 per cent. of nitrogen would theoretically give 147 lbs. of ammonium sulphate per ton of coal gasified. In practice, upwards of 80 lbs. of ammonium sulphate would be recovered from each ton of such coal passing through the producer, which may be valued at 9s. when sulphate of ammonia is selling at £12 a ton. This valuable bye-product has induced designers of producer plants to bring out various systems for its recovery—endeavouring at the same time to keep the gas up to a high grade for the use for which it may be required.

It must be understood that the principles entailed in generating producer-gas are the same, no matter which type of producer is used; and the author, in this connection, quoted from Wyer's "Treatise on Producer Gas and Gas Producers," where he says:

> For the proper understanding of the action of a gas producer, it is well to divide the charge of fuel in the producer into four zones.
>
> *Ash Zone:* The primary object of the ash zone is to keep the intense heat of the combustion of the fuel away from the grate and thus prevent "burning out." It also heats the air and steam before going to the combustion zone.
>
> *Combustion Zone:* In this zone the air and steam meet the carbon; the oxygen uniting with the incandescent C to form CO_2; while the steam is superheated and possibly begins to decompose.
>
> *Decomposition Zone:* This is where CO is generated, the steam decomposed into H, and the CO_2 reduced to CO. A large amount of heat will be absorbed in this zone to compensate for the carbonization of CO_2 and the decomposition of the steam. In order that the reactions may take place, the temperature must be kept above 1800° Fahr.
>
> *Distillation Zone:* This occupies the upper part of the fire. The addition of fresh fuel always reduces the temperature; but the heat from the lower zone distils the volatile constituents of the fresh fuel.

The nature of the hydrocarbons will depend upon the temperature. If the temperature in each zone is kept at the proper level, the hydrocarbons will be easily broken up and the hydrogen liberated.

It has to be remembered that it is one thing to design a producer plant and carry out carefully-considered tests under the supervision of highly-trained men, and quite another to carry on the daily work of the producer with varying qualities of fuel and the difficulty of determining the ratio of steam and air blast with the trouble of keeping up an even burning within the producer and all the many little causes that militate against the delivery of a constant supply of high-grade gas. The writer thinks that the description he proceeds to give of the working results of several different types of gas producers will show how all these difficulties are now overcome, and how a large proportion of the power required at a colliery can be generated, using a fair proportion of unsaleable fuel, and how bye-products can be recovered, in many places, sufficient to repay the whole cost of the fuel; and beyond this there is the inestimable advantage of carrying on large industries without polluting the surrounding country with volumes of dense smoke.

The descriptions of the results of working various types of producers are given in the following order:

(1) The Mond gas producers at Langwith, Nottinghamshire, and at Denaby Main and Brodsworth Collieries, Yorkshire.

(2) The Kerpely gas producer plants at the Shelton Iron, Steel, and Coal Company's works, Shelton, and at Messrs. Lumb and Company's glass works, Castleford.

(3) The Wilson gas producer plant at the Littleton Collieries, Stafford.

(4) The Dowson and Mason gas producer plant at Messrs. Smith and Faire's works, Leicester.

(5) The Kynoch "Cambridge" bituminous suction-gas producers, and the same Company's suction-gas plant for non-bituminous coals.

(6) The "Duff" gas producer, designed and erected by the Gas Power and Bye-Products Company, of Glasgow.

A lengthy illustrated description of these six different plants is given; and then the author summarizes his paper by saying: These descriptions do not by any means exhaust the number of gas producers now at work in this country. The nature of the fuel that it is desired to gasify is so varied that in almost every case some slight modifications are necessary. Consequently, it is essential to consider fully the varying circumstances of each case with one of the designers of such plant as may seem most likely to be able to deal successfully with the particular fuel that is to undergo gasification. From the information which he has collected, it may, he says, be gathered that, although low-grade fuels are not being generally used in gas producer plants, the results attained at the Shelton Company's and other plants show that a low-grade fuel is capable of being gasified, and that the resulting gas can be sufficiently purified for heating and power purposes.

At many collieries large quantities of "batty" coal are thrown back into the goaf; and in many cases where the coal at the top or the bottom of the seam is inferior, it is left in the mine—in fact, our coal-seams are being worked in a wasteful manner, as if there were no end to the store of our mineral wealth. It will, no doubt, be said that coalowners are not going to reduce the output of good saleable coal by sending out rubbish; and that the present-day strenuous wish to increase the output will not allow of rubbish being got and sent out of the mine. It has, however, to be remembered that every ton of unsaleable coal gasified saves at least half-a-ton of good coal.

The country cannot expect the coalowner to increase the cost of getting the merchantable fuel in order to use up the low-grade fuel now lost; but the country has a right to ask that our rapidly-diminishing supply of fuel shall not be wasted, and that our mining engineers, our chemists, and our mechanical engineers shall work together for the prevention of this waste.

In many parts of England there are seams of coal that are unsaleable at a profit at the present time, merely because they are unsuited to present-day requirements; but the gas producer and the gas-engine are now making this class of fuel available for generating power at a wonderfully low cost.

The art of utilizing low-grade fuel must be cultivated if we are to retain our great place in the world for generations to come. The designers of gas producer plants are actively engaged in meeting the many difficulties connected with the use of low-grade fuels. But the mining engineers who advise our large colliery companies are slow to advocate the erection of plant that may prove unsuitable for their special purposes; and so the advancement of science is checked.

Wales and Monmouthshire District Institution.—There will be a meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers at Caerphilly on Wednesday of next week, when the President (Mr. A. W. Branson, now of West Hartlepool) will deliver his address, which will be open to discussion. This will be followed by the presentation of the report and statement of accounts of the Special Purposes Section, an informal discussion on the "C" process [for which purpose Mr. John Bond, of Southport, will attend and address the members], and a paper by Mr. A. G. Leighton, on "Home Sales of Sulphate of Ammonia." Luncheon on the invitation of the Rhymney and Aber Valleys Gas and Water Company will precede an inspection of the gas-works and Caerphilly Castle.

Westminster Technical Institute Courses.—A copy of the prospectus of evening courses of instruction at the London County Council Westminster Technical Institute, Vincent Square, S.W., for the forthcoming session has been forwarded by the Principal (Mr. J. Stuart Ker, B.Sc.), who points out that, in view of the efforts now being made to open up new fields of industry, the necessity for the expansion of the work of technical education is more than ever necessary. The different classes begin this week; and they include gas engineering and manufacture, gas-fitting, gas supply, technical calculations and drawing, heating and ventilating engineering, and civil engineering. The courses in which readers are particularly interested are now so well known, and have been so successful, under the different teachers whose names appear in the prospectus, that it may suffice here to call attention to the opening of the new session. New students will, however, find a full indication of the scope of the different classes in the "JOURNAL" for Sept. 22 last [p. 674].

MITIGATION OF ELECTROLYSIS.

One of the recent "Notes" of the United States Bureau of Standards contained an abstract of a Technology Paper on the above-named subject. It discussed generally the question of electrolysis, and compared the conditions in America with those existing in other countries. Electrolytic corrosion proper, as distinguished from self-corrosion, was dealt with, and electrolytic effects in concrete and steel buildings were briefly touched upon. The effects of stray currents other than corrosion—for example, the production of fires or explosions—were also discussed. The abstract of the paper is as follows.

All the various methods of electrolysis mitigation which have been proposed or tried are discussed under two main heads: First, those applicable to underground pipe and cable systems; and, secondly, those applicable to the railway negative return. The methods applicable to underground pipe systems comprise the following: (1) Surface insulation of the pipes: (2) chemical protection—that is, rendering the pipe surface passive by surrounding it with earth filled with lime or other chemical that will prevent corrosion; (3) cement coatings; (4) cathodic protection—that is, maintaining the pipe or cable always negative to earth by means of a motor generator set or battery or other sources of electromotive force; (5) favourable location of pipe with respect to tracks; (6) the use of non-corrodible conducting coatings; (7) electric screens; (8) the use of insulating joints in pipes; (9) pipe drainage.

The discussion leads to the conclusion that, of the various methods under this class that have been tried, none are suitable for general use as primary means of preventing electrolysis trouble; and the methods of chemical protection, cement coatings, cathodic protection, and conducting coatings should be regarded as substantially worthless in the present state of development. Surface insulation of pipes by means of paints or dips is not much more reliable; but insulation by putting pipes in troughs or conduits filled with pitch may be used in special cases where the expense would be justified. The practice of placing all pipes as far as possible from railway tracks affords a certain measure of protection, of which advantage should always be taken wherever practicable in laying new lines or relaying old ones. The use of electric screens is often a valuable expedient in taking care of acute local cases of trouble in existing mains. These methods, with the exception of that relating to the proper location of pipes in new work, are suitable only to special conditions, however, and are not usually to be considered as important factors in any general plan for the mitigation of electrolysis.

Pipe drainage is sometimes useful; but it should be used with proper restriction, and with due precautions against setting-up dangerous conditions either in the system drained or in neighbouring systems. In general, in city networks where there are a number of independent underground systems to be protected, pipe drainage should be used as little as possible; the chief reliance being placed on mitigative measures applied to the railway negative return. The drainage of lead cable systems will, however, usually be desirable, and these should always be drained by means of suitable insulated feeder systems so arranged as to drain the least practicable current from the cables in order that neighbouring structures may not be subjected to unnecessary danger thereby.

The most valuable mitigative measure that can be applied to the pipe system consists in the proper use of insulating joints, and the extensive employment of such joints should be encouraged in new work in making repairs. Precautions are necessary in their use, however; and these are set forth in the discussion.

Taking up the methods applicable to the railway system, there is a very brief reference to the alternating-current system, double-trolley system, the use of negative trolley, and the periodic reversal of trolley polarity. This is followed by a somewhat extended discussion regarding methods of reducing potential differences in the uninsulated portion of the negative return. The discussion leads to the conclusion that the alternating-current system, the double-trolley system, the use of negative trolley, the periodic reversal of trolley polarity, and the use of uninsulated negative feeders in parallel with the rails, when considered solely as methods of electrolysis mitigation, are either impracticable or else open to the objection that the expense or operating difficulties attending their application are rendered unnecessary because of the fact that there are other adequate methods available for general application which are comparatively cheap to install and which introduce but slight complications into the operating system.

The importance of proper construction and maintenance of track return is emphasized, and the drainage of the roadbed where practicable is urged. Also where the track is laid on private right-of-way the rails and ties should be kept as far as possible out of direct contact with the earth by the use of good rock ballast. It is also pointed out that the three-wire system, when viewed solely from the standpoint of electrolysis mitigation, possesses large possibilities. Attention is called to the fact, however, that up to the present sufficient experience has not been had with this system to determine whether it is practical from the operating standpoint under average conditions of service. It is therefore urged that experiments with this system should be made under conditions to which it is best adapted.

The most effective methods that have been thoroughly tried in practice over long periods are the use of insulated negative feeders either with or without boosters, generally the latter. In most cases where the feeding distances are not too long, an insulated feeder system without boosters will prove cheapest and at the same time more satisfactory because of its greater simplicity. It is possible, by the proper application of such systems, to reduce the potential gradients in the earth to such low values that in most cases little damage would result. In many instances, however, it may be better, where conditions are favourable, to combine one of these methods, with either the insertion of a moderate number of insulating joints in the pipes or with the use of a very limited amount of pipe drainage, provided local conditions favour the use of this method. The insulated feeder system would be applied to reduce the potential gradients throughout the system to very low values, and one or other of the auxiliary systems used to eliminate largely any residual electrolysis that might remain.

The last section of the paper is devoted to a discussion of regulations regarding electrolysis mitigation. The subject of what criteria should be used for determining the adequacy of electrolysis conditions is taken up at some length, and it is shown that potential measurements having a total drop of potential in the railway negative return and also potential gradient measurements throughout the track network are very valuable. It is also shown that all-day average values of these potential readings give a better criterion of the actual danger from electrolysis than any short-time peak value. It is recommended that in fixing voltage limitations some plan analogous to the zone system should be adopted; the voltage limits prescribed for the various zones being determined largely by the degree of development of the underground utilities in the various zones. The voltage drops either in the tracks or in the pipes, and earth may be used as the basis for fixing limitations; but in general the latter is to be preferred. The question of what constitutes a safe limit for voltage drops in the track return is discussed at some length, and the conclusion is reached that for the overall potential drop in the railway tracks a limit of from two to four volts is reasonable and adequate, and the potential gradient should in general be restricted to 0·3 or 0·4 per 1000 feet—these figures being all-day average values. Where short-time peak values are used, the figures would, of course, be considerably higher.

In order that ready determination of voltage drops may be made at any time, potential wires should be installed, running from some central point to selected points on the railway or pipe networks. These points should include the points of approximately highest and lowest potential, and preferably also intermediate points. It is recommended that exemption from any regulations regarding track voltages should be made in special cases (as described in the paper) where local conditions make it improbable that any serious damage would result.

The responsibilities of the owners of underground utilities regarding the mitigation of electrolysis troubles is discussed, and it is recommended that any regulations governing electrolysis mitigation should be made to apply not alone to the railway system, but should also define the responsibilities of the owners of underground utilities, since the latter can often contribute materially to the diminution of the trouble at a cost that is, practically speaking, negligible.

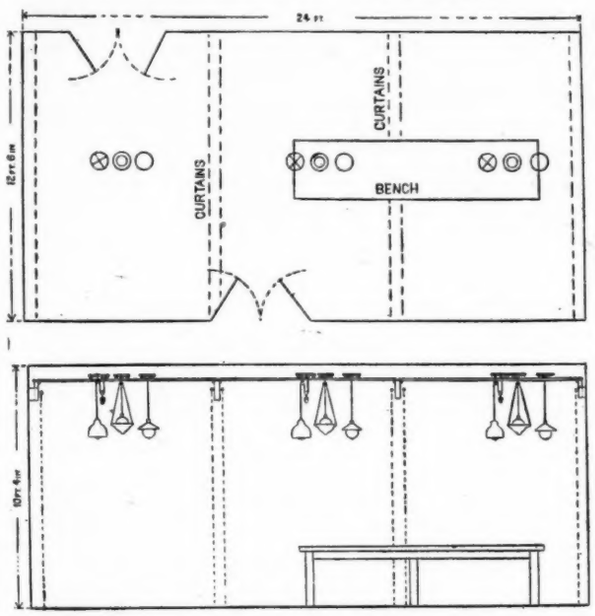
New Benzol and Toluol Works in America.—In an article entitled "The Manufacture of Coke Bye-Products in the United States," when referring to the supply of benzol and toluol in America, "Engineering" recently said: Benzol and toluol were not manufactured at all in America before the war. Consumers were supplied at cheap prices from Germany, where the manufacture of these auxiliary products is most advanced, so that there was little occasion for America to take up this manufacture; but now that importation from Germany has ceased, America has been compelled to erect works for the production of benzol. In the districts of the large steel-works, special efforts are being made to remain independent of imports after the war; and benzol works are being built. Difficulty has, in the meantime, been experienced in the completion of the works. A Westphalian firm which makes a speciality of erecting benzol works, and which had been entrusted with a large order for the Lackawanna Steel Company, has, from patriotic reasons, declined to complete the installation as long as the war lasts. The Lehigh Coke Company had also commissioned the same German firm to build a benzol-works with a capacity of 1300 gallons per day, at a cost of $350,000. For these works only the foundations have been laid; and they will, in any case, not be finished before the end of the war. So the Company is debarred from deriving any benefit from the present market position of benzol in the States. The Carnegie Steel Company, which also had entered upon an agreement with the Westphalian firm for the erection of benzol works—the completion of which, however, has been postponed for the same reasons—have annulled their agreement, and are now attempting to finish the factory themselves. It is, however, very questionable whether they will succeed in doing this without delay, as the construction of such works is connected with some important patents, which are controlled by the Westphalian firm. The price of benzol in the United States has risen from 20 c. to $1 per gallon since the war broke out.

WORKERS AND LIGHTING EXPERIMENTS AT THE NATIONAL PHYSICAL LABORATORY.

In the recently issued report of the Departmental Committee on Workshop and Factory Lighting, a very interesting account was included [in Appendix XIV.] of the experimental room at the National Physical Laboratory at Teddington, in which a considerable number of the tests made by direction of the members were carried out. It was equipped with different methods of lighting, and so arranged that the illumination by each method could be readily varied in degree. Various phenomena brought to the notice of the Committee by witnesses were examined in this room; workpeople were tested to ascertain the illumination required for their work; and the members of the Committee made experiments under conditions of illumination similar to those existing in the various factories which were inspected by them.

Description of Room.

The room was rectangular in plan, 24 feet long by 12 ft. 6 in. wide; the height from floor to ceiling being 10 ft. 4 in. The whole of the wall surface, as well as the ceiling, was whitened, in order to reproduce the conditions obtaining in a small factory room. At the same time black curtains were provided, which could be drawn across the white walls—thus approximating to the conditions in the centre of a large factory room, where the effect of the light reflected from white walls is negligible.



Plan and Elevation of the Experimental Room at the National Physical Laboratory.

In addition to this, the room could be partitioned into three compartments by means of white or black curtains—each compartment being illuminated with its own lamps. In this way, an observer could pass quickly from one set of previously arranged lighting conditions to another. Comparisons under these conditions were thus made possible without the necessity of any intermediate adjustment.

The following three systems of illumination were installed:

(1) Direct lighting by unobscured metal filament lamps with ordinary opal glass shades. The height of the centre of these lamps above the floor was 7 ft. 6 in.

(2) Indirect lighting by metal filament lamps with inverted white reflectors, which intercepted all downward light and reflected it upwards upon the ceiling, whence it was diffused over the room. The height of these lamps was the same as those of system (1).

(3) Shielded lighting, in which similar lamps to those used in system (1) were enclosed in aluminium shades of approximately parabolic form. These shades shielded the eyes from the direct light of the lamp, throwing it in a downward direction upon the table beneath. The height of these lamps could be varied at will.

By means of resistances placed in circuit with the lamps, any degree of illumination up to the maximum of (approximately) 12-foot candles—underneath the lamps—could be readily obtained. To obviate the difficulty arising from the difference in colour of the light when the lamps were running at very low voltages, it was possible to replace the ordinarily used lamps by others of smaller candle power.

Electric light was used in the equipment of this room on account of the greater ease of regulation for experimental laboratory purposes. So long as a suitable and conveniently adjustable means of lighting was available, it was not of consequence for the purpose of the experiments whether it was from gas or electric lamps.

In the case of the indirect lighting, the illumination did not vary seriously over the area below the lamps; but with the direct lighting, the illumination midway between the lamps was 70 per cent. of that immediately underneath them.

The uniformity of illumination from the shielded lights was more dependent than in the case of the others on their height above the table; but this system was used mainly for the examination of the effects of local lighting.

It was found that the reduction in the illumination at the centre of the room, due to the blackening of the walls, was approximately 25 per cent. in the case of direct lighting, 7 per cent. for indirect lighting, and negligible for the shielded lights.

Experiments with Workpeople.

The workpeople mainly examined were seamstresses from the workrooms of some of the principal London outfitting firms. They were examined two at a time—each examination lasting for about a day. In addition to these, two tailors from the East End of London have been examined; but the results obtained require supplementing and confirming before they can be considered reliable. In the case, however, of the seamstresses, three entirely independent examinations were made; and the measure of agreement which the results afford indicates that they may be accepted as of fairly general application for the type of work upon which they were engaged.

The workpeople were asked to work on various materials, mostly without any pattern, with cotton of the same colour as the material. Chief attention was paid to white and black cloths, as representing the two extremes. For work on any given material, the illumination to start with was put at a value which the workers stated was too low for the work in question. It was then raised by a definite amount, and the two workers under examination were left to sew for fifteen or twenty minutes, after which they were asked whether in their opinion the illumination was sufficient for the work they were doing. If it was not sufficient, a further increase was made; and they were left to work for a further period. In this way, an illumination was reached which the workers considered sufficient for the work in question. With the lighter materials, this point was in all cases quite definite; but when working with black cloth, although the workers stated that (for instance) 4 foot-candles was sufficient by which to see their work, they all considered that it was not really a high enough illumination for comfort. The illumination for comfortable working with black cloth proved on the average to be about 5½ foot-candles. Similar tests were made with each pair of workers; and the following table gives the decisions arrived at by each one of them, together with data as to the coefficient of reflection of the materials worked upon:

Illumination required by Seamstresses for Working on Different Self-Coloured Materials with Threads to Match the Material.

Material.	Coefficient of Reflection.	Worker.	Minimum Satisfactory Direct Illumination for Continuous Work.	Illumination which was Comfortable to Work with and which may be Considered as Ample.
	Per Cent.	Miss.	Foot-Candles.	Foot-Candles.
White calico.	97	S.	1½	
		W.	1½	
		O.	1½	
		F.	1½	
		B.	1½	
		L.	1½	
Holland colour.	52	S.	1½	
		W.	1½	
		O.	1½	
		F.	1½	
		B.	1½	
		L.	1½	
Slate colour.	12	S.	2	
		W.	2	
		O.	1⅔	
		F.	1⅔	
		B.	1½	
		L.	1½	
Purple, with strongly-marked sheen.	8	S.	2	
		W.	2	
		O.	2½	
		F.	2	
		B.	2	
		L.	2	
Black.	2·4	S.	4	5½
		W.	4	5½
		O.	4	5
		F.	4	5
		B.	4	5–6
		L.	4	5–6
Black velvet.	—	S.	4	
		W.	4	
		O.		5
		F.		5
Embroidery.	11	B.	2	3
		L.	2	3

All the results given were obtained with "direct light"—that is to say, the light was received directly from a lamp placed above the worker in such a way as to be free from glare. Many tests were also made with the object of ascertaining the relative ease with which sewing work could be carried out with "direct" and "indirect" light respectively. When, for any given material worked upon, the value of "direct" illumination had been decided on which was regarded by the workers as adequate, the lighting was quickly switched-over to the "indirect" type of equal intensity. The decided opinion of the workers in every case was that the "indirect" illumination, even though it might be equal in intensity to the "direct" illumination, was inadequate, and required to be very appreciably increased for sewing work. The increase asked for was in one case 100 per cent., and in others about 40 per cent. The reason for this was investigated separately, and is dealt with later.

The sight of each seamstress was examined for errors requiring correction with glasses. Several of the workers proved to have imperfect sight, but did not appear to show any desire for a higher illumination by which to work than those with normal sight. Trials were also made with blackened, instead of whitened, walls; but, provided the illumination on the work was arranged to be the same in both cases, the workers did not find that their ability to carry on work was affected.

[There is introduced at this point a report by Mr. J. Herbert Parsons, M.B., D.Sc., F.R.C.S., on the eyesight of the six seamstresses whose work was being tested.]

Observations by the Committee in the Experimental Room.

Degrees of Illumination.—The illumination in the room was adjusted to different values from 0·1 foot-candle to 10 foot-candles; and at each illumination the members of the Committee tested their ability to distinguish detail by means of cards with figures printed on them in ordinary type, varying from a height of 1·2 mm. to 2·8 mm. The cards were of different colours, from white to dark blue; so that the contrast between the black figures and coloured cards varied appreciably. The observations were made with (*a*) thoroughly diffused light (indirect), (*b*) direct light from exposed sources, (*c*) direct light from well-shaded sources. It was found that while it was possible to read the smallest type on the white cards at an illumination of about 0·75 foot-candle, the small figures on the dark blue cards could not be seen with an illumination of 6 foot-candles. The type of illumination, whether direct or indirect, made no difference to the ability to see, so long as there was no direct reflection from the surface of the cards. An illumination of from 3 to 4 foot-candles gave the impression from general observation of a well-lighted room; while it appeared that from 0·1 to 0·25 foot-candle would be the order of illumination which would suffice for corridors.

White and Black Walls.—The effect was studied of illumination by direct and indirect light both with and without the presence of white walls. The increased restfulness of the diffused (indirect) light was noted, and also the annoyance through the glare of bare lights, particularly when these were seen against a dark background.

Perception of Detail by Direct and Indirect Light.—The ability to discern the details in fabrics was tested both by direct and indirect light; and it was found that the absence of shadow which resulted from using indirect light seriously impaired the ability to see in detail the separate threads in a self-coloured cloth.

Diversity Factor.—A long workbench was illuminated by direct light from three sources, and in such a way that the illumination at the ends was one-seventh of that in the centre. To ordinary observation, unaided by measurements, the actual difference of illumination appeared to be much less than this.

Glare.—A test-card, having figures printed on it, was fixed at eye-height, and an observer adjusted his distance from it so that he could just read the lines of figures. The time taken by him to read the lines of figures was noted, after which a 100-candle power lamp was placed in front of him, so that the vertical distance between the lamp and test-card subtended an angle of about 20° at his eye. The time required to read through the figures under these conditions of glare was again noted. Precautions were taken to ensure that the illumination on the card was the same in the two series of readings. At illuminations from 2 to 4 foot-candles, there was no diminution of ability to read the figures; but with an illumination of 0·5 foot-candle, the exposed source of light rendered it practically impossible to distinguish them.

Ability to See Detail in Different Materials of the Same Surface Brightness.—Blue fabrics of identical texture but varying from very light to very dark blue* were examined under conditions of illumination such that the surface brightness of all the fabrics was the same. That is to say:

Coefficient of reflection × illumination = constant.

In the opinion of the Committee when the above relation held, the ability to distinguish detail in all the fabrics was the same. The matter, however, required further investigation.

This question was subsequently further investigated by Mr. W. C. D. Whetham, F.R.S., a member of the Committee, who reports as follows:

It is a matter of common knowledge, confirmed conclusively by evidence given to the Committee by operatives, that more light is required in factories where the colour of the material worked upon is dark than where it is light. This fact would make all attempts to define "adequate illumination" almost hopeless unless some new criterion can be discovered.

Dark coloured substances look dark because they reflect much less light to the eye than light coloured substances; and it seemed possible that the power of distinguishing detail, on which comfort and quality depend, would be related to the actual amount of light which entered the eye—that is, to the surface brightness of the material—rather than to the amount of light falling on the work—that is, the illumination.

To examine this question, an investigation was carried out at the National Physical Laboratory with the skilful help of Mr. Bernard P. Dudding; the arrangements being previously made under the superintendence of Mr. C. C. Paterson. The work was carried out in a dark room, in which the illumination given by electric light was under control.

In the first series of experiments, four samples of calico were used. They were dyed different tints of blue, ranging from very light to very dark, almost black. The illumination was slowly raised by an assistant till the observer, who was ignorant of the illumination reached, was able to distinguish the threads of the warp and weft of the calico. The illumination was then kept steady, and measurements taken of the illumination and of the surface brightness of the material relative to the surface brightness of the white card of the lumeter. The following results were obtained:

Observer "W.C.D.W."

Illumination Needed to Make the Threads Visible. (Foot-candles.)	Corresponding Surface Brightness.
(I.) *Very Light Blue Calico.*	
1·4	0·7
1·65	0·9
1·4	0·7
(II.) *Light Blue Calico.*	
2·0	0·75
1·7	0·70
(III.) *Full Blue Calico.*	
4·8	0·63
5·8	0·86
(IV.) *Dark Blue Calico.*	
12·0	0·62
12·5	0·68

Observer "B.P.D."

(I.) *Very Light Blue Calico.*	
1·0	0·64
0·8	0·52
(II.) *Light Blue Calico.*	
1·9	0·72
1·3	0·50
(III.) *Full Blue Calico.*	
4·0	0·52
3·6	0·48
(IV.) *Dark Blue Calico.*	
10·5	0·60
14·0	0·85

Hence it appears:

(1) That the illumination needed to make work possible on a very dark material may be ten times that required with a very light material.

(2) That, on the other hand, the requisite surface brightness is constant within the limits of experimental error.

(3) That the average surface brightness needed to make the threads of calico of different tints visible to one normal eye ("W.C.D.W.") may be represented by 0·73, and to another normal eye ("B.P.D.") by 0·60.

Another series of experiments were made with coloured cards on which rows of figures were printed. Here the visibility depends on the contrast of colour between the coloured card and the black ink. The problem is, therefore, different from that of the adequate illumination of calico where the visibility depends on the shadow cast by the threads.

Observer "W.C.D.W."

Illumination Needed to Make Print Legible.		Corresponding Surface Brightness.
0·144	white card	0·13
0·125	pink card	0·11
0·50	light-blue card	0·19
0·80	dark-blue card	0·20

Observer "B.P.D."

0·04	white card	0·044
0·05	pink card	0·044
0·104	light-blue card	0·048
0·20	dark-blue card	0·052

In this case, while the illumination needed to make print legible on a dark-blue card is some five times that required with a white card, the surface brightness is nearly constant, though there are some indications that it tends slightly to increase with the darker colours. This is natural, as with a black card black print would be presumably invisible at all illuminations. But, except in this extreme case, there seems reason to believe from experiments that, for a given kind of work, it may be found that the necessary surface brightness is independent of the colour of the material.

* The approximate coefficients of diffused reflection of the three principal fabrics examined (expressed as a percentage of incident light which was diffusely reflected), were as follows:

Dark blue	6 per cent.
Medium blue	14 per cent.
Light blue	40 per cent.

Perception of Detail by Direct and Indirect Light.

The degree of illumination required for the purpose of distinguishing detail under different systems of illumination was the subject of further experiment. The investigations described above were repeated by other observers, and the conclusions before arrived at were confirmed—viz., that the threads of different coloured materials could be just distinguished when the illumination was raised to such a value that the surface brightness of the different materials was the same. In order further to amplify these experiments under more rigid conditions, an investigation was carried out at the National Physical Laboratory by Mr. J. W. T. Walsh, using embossed matt-papers of different shades of grey, but all non-selective in their diffusion properties. Ten different specimens of toned paper were used, varying in shade from very dark to very light grey. They were embossed from a copper plate having an arbitrary design which included lines of many different depths—the embossing being carefully performed in a hand-press, so that the mattness of the surface of the papers was as far as possible unaffected. The papers were then illuminated from a single and relatively small source of light, and viewed from a fixed distance and in a definite direction.

It will be observed that the visibility of the embossed pattern depends: (1) On the variation of the surface brightness over the raised portions of the pattern, due to changes in the angle which such surfaces make with the direction from which the light comes; (2) on the shadows cast on the background by the raised portions of the pattern. Both of these effects depend upon whether the light comes from one single direction, or from a number of widely different directions.

The illumination was gradually raised until one particular part of the embossed design (which was of medium fineness) could be just discerned, while another finer portion could not. In this way it was found possible to obtain results which were reproducible to a considerable degree of accuracy.

The results obtained are given in the following table:

Paper No.	Approximate Coefficient of Reflection.	Surface Brightness at Point of Visibility of Design.
	Per Cent.	Foot-Candles.
1	80	0·031
2	60	0·029
3	37	0·030
4	23	0·027
5	21	0·031
6	17	0·033
7	16	0·028
9	11	0·027
10	9½	0·032
11	3½	0·027

The figures in the last column show the remarkable constancy of the surface brightness required for the perception of detail by direct light, where such perception mainly depends on the contrast between the brightness of the ground surface and that of the shadows cast by the embossed detail or on the variation of brightness over the surface of such detail.

In the case of indirect lighting no such definite conclusions could be arrived at; but it was readily apparent that for equal ease in distinguishing detail, a considerably greater illumination was required than in the case of direct light. This is only to be expected, having regard to the fact that the shadows shown by indirect light are always far less intense than those given by direct light, and that the variation of illumination over a curved surface is also much less with diffused light. The superiority of direct light for sewing was insisted on by the seamstresses who worked in the experimental room under different illumination conditions.

Some of the main conclusions arrived at as the results of experiments made at the National Physical Laboratory may be summarized as follows:

(1) The illumination required for the perception of detail in materials having a low coefficient of reflection is greater than for those which reflect more strongly, and, other things being equal, is inversely proportional to such coefficients of reflection—that is to say, for equal visibility there must be constant surface brightness.

(2) The visibility of detail in self-toned portions of fabrics, embossed paper, and similar substances depends on the unidirectional character of the light illuminating them. It follows, and has been shown experimentally, that the ability to distinguish detail in such substances is for the same illumination much greater by direct than by indirect light.

(3) Work such as sewing may be comfortably performed on the darkest materials with an illumination of 5 to 6 foot-candles (direct lighting); for white calico, 1¼ foot-candles was found sufficient; and intermediate shades were found to lie between these values.

(4) The observations on the phenomena of glare have not as yet yielded definite numerical results. They have shown, however, that the presence of a bright lateral light, although causing a feeling of annoyance, does not actually diminish ability to distinguish detail unless the surface brightness of the object viewed is relatively low.

CARBONATE OF POTASH FOR PURIFYING GAS.

A new system for the extraction of sulphur and cyanogen from coal gas by means of a solution of carbonate of potash was the subject of an article by Heer Th. Petit in a recent number of "Het Gas." The following is an abstract translation of it.

The dry purification of gas is becoming troublesome to gas managers, and they have consequently exercised their skill in trying to supersede it. The result has been the taking out of numerous patents for the extraction of cyanogen and sulphuretted hydrogen by the wet method. The Feld and Burkheiser processes have been frequently referred to; but, though there has been a large expenditure of money, the results achieved have not been such as to allow of the introduction of the processes into gas-works generally. Should sulphur purification by the wet method ever find its way into gas-works practice, the chemical control of the system ought to be as easy as that of an ammonia washer. Heer Petit has patented a new process, the entire plant for which consists of two rotary washers, one of which serves for revivifying the liquid which has been saturated with sulphuretted hydrogen in the other. This liquid consists of a solution of carbonates and hydro- or bi- carbonates of the alkaline earths and alkalis. Preference is given to a solution of carbonate of potash (K_2CO_3), for the reason that, during the whole course of the process, no sediment is produced, and the liquid remains as clear as water. In the sequence of the purifying plant, the sulphur washers are placed after the ammonia washers.

A solution of carbonate of potash has basic properties. Carbon dioxide is absorbed, and causes the formation of bicarbonate:

$$(1)\quad K_2CO_3 + CO_2 + H_2O = 2KHCO_3$$

It is evident that potash will also take up the other weak acids, such as sulphuretted hydrogen and cyanogen. In practice this is what really occurs, and they are absorbed with the formation of bicarbonate:

$$(2)\quad H_2S + K_2CO_3 = KSH + KHCO_3$$
$$HCN + K_2CO_3 = KCN + KHCO_3$$

When foul gas is treated with a solution of carbonate of potash, the impurities are absorbed, and the gas leaves the washer in a purified state. The washing is very active: A solution of 17 per cent. of K_2CO_3 is saturated with 0·80 per cent. of H_2S; one of 25 per cent. with 1·20 per cent. H_2S; and one of 60 per cent. with 3·80 per cent. H_2S. Coal gas treated in the customary manner with oxide of iron contains 60 grammes (926 grains) of sulphur in 100 cubic metres (3530 cubic feet); but the same gas treated with potash lye will contain no more than 35 grammes (540 grains). This is also the case with the cyanogen, which is almost totally absorbed.

The great merit claimed for the Petit system is that the potash solution can be perfectly regenerated by an exceedingly simple method. Air is passed through the saturated solution, and after some time it will have taken out the sulphuretted hydrogen and cyanogen, and the solution will be again in a working condition.

$$(3)\quad KSH + KHCO_3 = K_2CO_3 + H_2S$$
$$KCN + KHCO_3 = K_2CO_3 + HCN$$

Air does not remove from a neutral solution the two gases named; and the special feature is that the carbonate is present in the form of bicarbonate. The air leaving the regenerating liquid contains about 2 per cent. of sulphuretted hydrogen, and it may be treated for the production of free sulphur or of sulphuric acid. Of course, this is only remunerative in large gas-works and with installations of coke-ovens. In small works the sulphur-laden air has to be conveyed into the chimney.

The influence of the amount of carbon dioxide in the gas will now be considered. In ordinary practice, most gases contain a certain amount of CO_2. Coal gas, for instance, has generally 1·5 or 2 per cent.; coke-oven gas has slightly more—viz., 2 or 2·5 per cent.; and carburetted water gas plants, in regular working, about 3 per cent. As carbon dioxide is also absorbed by a solution of potash, the question arises whether the sulphur extraction is interfered with by the amount of CO_2. Experiments have shown that, as a matter of fact, the absorption of sulphur is retarded, but that with low percentages it is by no means impossible. One is inclined to suppose that during the washing process all carbonate is converted into bicarbonate, causing the elimination of the sulphuretted hydrogen already absorbed. This is not the case; for between the carbon dioxide in the gas and the carbonate and bicarbonate of potash in solution equilibrium is set up.

When air is passed through a solution of bicarbonate of potash, this salt is partly dissociated, and the air takes up a certain amount of carbon dioxide.

Amount of $KHCO_3$.	Temperature.	CO_2 in Issuing Air.
210 grammes per litre	19° C.	5·2 per cent.
105 " " "	"	2·6 "
53 " " "	"	1·3 "
27 " " "	"	0·7 "

The air will remove a portion of the carbon dioxide until equilibrium is produced; then there is in the solution a mixture of carbonate and bicarbonate of potash. When, on the other hand, we come to take a solution containing directly a mixture of

carbonate and bicarbonate, equilibrium is much sooner reached, and dissociation of carbon dioxide comes to a standstill.

Grammes per Litre $KHCO_3$	Grammes per Litre K_2CO_3	Temperature.	CO_2 in Issuing Air.
230	—	19° C.	5·7 per cent.
216	10	,,	3·7 ,,
202	20	,,	1·6 ,,
188	30	,,	0·6 ,,
160	50	,,	0·1 ,,

Of course, the influence of temperature is very great, as is generally the case with all dissociation phenomena. Taking, for instance, a solution with 170 grammes of $KHCO_3$ per litre, the figures are as follows:

Temperature.	CO_2 in Issuing Air.	Temperature.	CO_2 in Issuing Air.
5° C.	2·5 per cent.	21° C.	5·2 per cent.
12° ,,	3·4 ,,	26° ,,	6·4 ,,
16° ,,	4·2 ,,	30° ,,	7·5 ,,

In practice, the result will be an equilibrium in the solution between sulphuretted hydrogen, carbon dioxide, and carbonate and bicarbonate of potash, and when this equilibrium has been obtained the liquor is saturated.

During the regenerating process, the air passing through the solution will not only take out the sulphuretted hydrogen, but also part of the carbon dioxide. The regenerated liquor is therefore also in the condition to take out some carbon dioxide from the gas in the next washing operation, and the CO_2 is lowered to about 0·5 per cent.

The foregoing theoretical explanations furnish the reason for a pure solution of bicarbonate of potash also taking out sulphuretted hydrogen. The treated gas begins with the elimination of as much carbon dioxide as will set up equilibrium, and then the absorption of sulphuretted hydrogen takes place. In the regeneration process, the air serves only as a carrier for the issuing gases, carbon dioxide, and sulphuretted hydrogen, and is not the cause of any oxidizing process. Liquors which have served fifty times contain no sulphur salts; and the amount of cyanogen does not in general cause any formation of sulphocyanides—this only being the case when the ammonia washing is insufficient.

A method has been sought to increase the speed of the regeneration process. It has been found that a slight addition of carbon dioxide to the air increases the velocity considerably; for in this case the bicarbonate in the solution is less dissociated, and sulphuretted hydrogen is much more easily driven out. But, on the other hand, the amount of carbon dioxide should not be too high, as the liquor will not have sufficient activity. It has been found that 2 or 3 per cent. will do; and this is very easily effected by mixing chimney gases with the air. It is of some importance, however, that no sulphur dioxide or trioxide should be present in these gases. The heating of the saturated liquor to 40° or 50° C. during regeneration will also increase the process considerably.

The chemical control of the process is very simple, and may be carried out by a skilled foreman. It is done with acetate of lead paper. The regenerative process is tested by means of a solution of nitro-prussiate, and is to be continued until this reagent no longer takes a purple colour with the liquor. The amount of sulphuretted hydrogen in the washing liquor is estimated with a decinormal solution of iodine.

Increase in the Price of Mantles in Germany.

The "Journal für Gasbeleuchtung" of the 4th inst., reported that it had received a circular stating that at a joint meeting held in Berlin on July 19, of the Union of German Mantle-Makers and the Association of Independent Mantle-Makers, the question of an increase in the selling price of mantles was considered, and it was decided that, in view of the considerable increase in the cost of manufacture, the retail price should be raised by pf. 5, making, with the similar increase at the end of March last, a total increase of pf. 10 [1·1d.] since the outbreak of war. This increase refers to the ordinary size of mantle for upright and inverted burners. For other mantles, the increase varies according to their size and quality. The circular states that the increase in the cost of manufacture has been brought about specially by the impossibility of importing certain raw materials, and by the State embargo on certain chemicals, which are used directly or indirectly in the manufacture. Quite recently there has been a particularly great increase in the price of thorium nitrate—consequent on certain acids which are absolutely necessary for its manufacture having been expropriated by the State.

Companies Trading with the Enemy.—A Royal Proclamation has been issued in a supplement to the "Gazette" stating that doubts have arisen respecting the position, under the Proclamations relating to Trading with the Enemy, of incorporated companies or bodies of persons which, though not incorporated in any enemy country or in territory in hostile occupation, carry on business in any such country or territory. The expression "enemy," notwithstanding anything in the said Proclamations, is therefore declared to include, and to have included, any incorporated company or body of persons (wherever incorporated) carrying on business in an enemy country or in any territory for the time being in hostile occupation.

TRANSPORTATION OF NATURAL GAS.

In the earlier days of the supply of natural gas, great difficulty was experienced in constructing a pipe-line sufficiently good and cheap to make the commercial transportation of the gas feasible for any great distances. It was stated by Mr. J. P. Fisher, in a paper recently read before the American Society of Mechanical Engineers, that in order to meet the troubles which arose a new type of coupling was developed, consisting of a centre-piece, which slipped over the ends of the two lengths of pipe to be joined, two glands or end rings, two rubber packers, and connecting bolts between the two end rings—the whole forming a double stuffing-box arrangement. This coupling proved to possess many advantages over any form of joint previously used; and with it lines that were very nearly free from leaks, if sufficient care was taken in their construction, were found possible. Lines could also be made of lighter pipe, and still carry the same or higher pressures than was possible with threaded joints. This improvement has greatly increased the distance it is possible to transport gas profitably; and, though the joint has many grave weaknesses, it is the best available at the present time.

Recently there have been some short lines laid in which the pipe was welded together end to end. This practice is too new to prove its success; but it seems to promise the solution of difficulties due to leakage and deterioration of the rubber-packed joints now commonly used. Like pipe joined by screw joints, the line will be subjected to heavy strains due to temperature changes; and it is likely that special provisions in expansion joints will have to be made for this condition.

In the early days, the natural pressure of the gas as it occurred in the fields was the source of power used for its transportation. As the fields neared exhaustion, or when the distances from the fields to the points of consumption were too large, the pressure fell too low; and it became necessary to increase it artificially by means of compressors of one type or another. In many of the earlier plants, attempts were made to locate these compressors in the towns and draw the gas through the lines by suction. These attempts failed; and it became the practice to locate the stations in or near the fields. At the present time, practically every gas transportation company has to keep up a system of compressing stations in order properly to maintain and control the amount of gas passing through its lines.

Most of the larger natural gas systems of the country have been the result of a process of evolution in which lines were extended farther and farther to reach one field after another, and in which one compressing station after another has been built, usually for the purpose of putting gas from a declining local field into the main trunk line. Another factor in this evolution has been the necessity of small companies combining in order to be able to go to greater distances for a common additional supply, when the old sources of supply were exhausted.

It is, says the author, estimated that the gas escaping from the Cushing field [one of the main sources of supply in the Mid-Continental region] is about 400,000,000 cubic feet per day, or about 11,000 tons. This would be equivalent in fuel value to a train load of coal of 300 to 400 cars of average capacity. Of the gas in this field, only about 10 per cent. ever gets into a pipe-line or is used as fuel. The problem here is mostly one of proper government and control, so far as the community at large is concerned, and financial, so far as the transportation company is concerned. As the gas in the Cushing field comes from the well, it is very far from pure or a perfect gas. It is composed largely of methane, with considerable quantities of the heavier hydrocarbons, ranging from those which at ordinary atmospheric conditions are vapours and are considered as part of the gas proper, down to heavy oils, and often salt water. The liquids are held in suspension as a fog or mist, or run along the bottom of the pipe and collect in low places. Between these extremes are all those compounds usually known as gasoline or flashy gasoline. Dirt, sand, &c., are also often present.

The first problem in the transportation of this gas was to separate dust and dirt, and such liquids as water, oil, or gasoline. For this purpose drips or separators were provided in the lines from the wells to the main trunk line. Any liquid not taken out by the field-drips tends to collect in low sections of the line, and drips should be provided at all these low points. If pockets of liquid occur in the line, they cause the flow of gas to be pulsating instead of steady. This pulsating is difficult to entirely overcome, and is one of the chief sources of trouble in the operation of measuring stations.

Gasoline and oil are the main cause of rapid deterioration in the joints in the pipe-lines, which are usually packed by rubber or composition rings. The oil and gasoline attack the rubber rings quite actively, and sooner or later cause leaks and blow-outs—especially as the pressure carried in the line is from 200 to 400 lbs. per square inch. Several substitutes for rubber are being used, and seem more resistant; but the only way to eliminate trouble from this cause is to keep gasoline and oil out of the line.

An idea of some of the problems incident to a compressing station may be obtained by a consideration of a typical compressing station of approximately 3000 H.P., which is capable of compressing about 40,000,000 cubic feet of gas per 24 hours through three compressions and delivering it at 350 lbs. gauge pressure. Up to this station the gas is transported by the natural field pressure. The prime function of the station is to re-compress the

gas, which has dropped to a pressure too low for economical transportation, to a pressure high enough to deliver the requisite quantity through the remainder of the line right up to the points of consumption.

One of the chief problems is that of the condensation of gasoline in the line beyond the station. As the gas leaves the field, its pressure has been diminishing and its capacity for carrying gasoline as a vapour increasing. There is, therefore, little danger of deposit of gasoline in the line between the field and the compressing station. At the compressing station, the pressure of the gas is raised to 300 lbs. per square inch, or higher, and its temperature raised to from 210° to 240° Fahr. After compression, the gas is passed through a cooler, consisting of a large number of pipes in an open pond of water. Only occasionally is the temperature in the cooler low enough to condense out any great proportion of the vapours condensable at this pressure and line temperature. A separator is provided at the outlet of the cooler; but it can only take out vapours already condensed. It is, therefore, apparent that there is a possibility of further condensation of gasoline in the pipe-line beyond the compressor station; and this is exactly what occurs.

One very important function of a natural gas line is the equalization of the rate of production. The demand for gas in a city varies greatly from hour to hour of the day, being several times as great in the daytime as at night; and it also varies greatly with atmospheric temperature. It would be a difficult matter to vary the output of a compressing station or a field at a distance from a town to meet the widely varying demand, if it were not for the equalizing effect of the transmission line. When the supply is greater than the demand, the gas is being stored in the line, and is available when the demand suddenly becomes much greater than the rate of supply. Often this equalizing effect will enable gas to be taken into the line at a uniform rate from the field for days at a time, while the demand at the other end of the line is fluctuating widely.

Finally, regarding the problem of transporting gas by means of pipe-lines and compressing stations, remarks Mr. Fisher, the gas fields are not only stores of latent energy in the form of fuel, but also stores of latent energy directly available as power in the highly compressed state of the gas. At present the pressure energy is used quite wastefully in the transportation of the gas itself. If, instead of allowing the pressure of the gas to drop to one-third or one-fourth of its initial value before re-compressing it, the pressure could be maintained at a high point, a great reduction in the total power required to transport the gas could be made. This would point to smaller compressing stations located at shorter intervals along the line. These stations would require less total power than stations at greater intervals performing the same service; and they could be simplified greatly by the omission of the after-cooler, as the smaller range of compression would not raise the temperature of the gas to an objectionable point.

USE OF TAR FOR DUST PREVENTION AND ROAD PRESERVATION IN AMERICA.

A professional paper—Bulletin No. 257 of the United States Department of Agriculture—is a contribution from the Office of Public Roads, which gives reports on the progress of experiments on dust prevention and road preservation carried out in various parts of the United States last year. Many of them are in continuation of experiments begun in earlier years, and consist in the re-surfacing or renewal of test sections of road which had shown signs of wear or failure.

The experiments deal with many oil and asphaltic preparations, but a certain number relate to trials of prepared coal tar and water gas tar. The particulars given of these materials and the general results of the experiments with them have been abstracted in the appended table. It will be seen that few of the tars used fulfil the requirements of the Road Board of this country; and in cases where unsatisfactory results are reported they may be clearly traced to the unsuitableness of the grade of tar used. In considering the results recorded, attention should, however, be given to the climatic conditions of the district in which each experiment was made.

The data given may, as a whole, be of service to distillers and surveyors in this country, as a guide to the composition and characteristics of tar preparations for use in the treatment of roads. Generally speaking, it may be said that the oil and asphaltic materials, on which reports are included in the same paper, have not shown a higher proportion of satisfactory results than the tar preparations referred to in the table.

Results of Experiments on the Use of Tar for Dust Prevention and Road Preservation in America.

Place.	Lemon City, Florida.		West Palm Beach, Florida.		Rockville Pike, Maryland.	Washington, District of Columbia.	Chevy Chase, Maryland.
Nature of Stone or Road Crust.	Screened Coralline Rock.		Screened Coralline Rock.		Tarred Macadam.	Tarred Macadam.	Tarred Macadam.
Method of Applying Tar.	Surface Treatment.	Penetration.	Penetration.	Penetration.	Renewal of Tar Coating.	Renewal of Tar Coating.	Renewal of Tar Coating.
Temperature of tar on application.	Cold	194° F.	347° F.	365° F.	150–175° F.	Cold	Cold
Nature of tar.	Water gas tar preparation	Water gas tar preparation.	Refined coal tar	Refined coal tar	Refined water gas tar	Water gas tar preparation	Crude coal tar
Tar per square yard, Imperial gallons	No. 1, 0·21, and No. 2, 0·35	No. 2, 0·90	No. 1, 0·81, light coal tar (cold) 0·27	No. 2, 1·0	0·245	0·147	0·263
Condition of road about twelve months after treatment	Fine grained Mosaic surface; a few incipient potholes	Perfect Mosaic surface with slight indentations	Good, but bituminous materia become hard and brittle	Tar become hard and friable. Surface treatment with tar required	Surface good, especially where ¾ in. gravel had been used as covering material instead of trap rock chips	Reddish brown colour; worn off in well-defined areas, but generally smooth and uniform	Surface smooth and hard; a few irregularities only
Analysis of tar	No. 1	No. 2.	No. 1	No. 2	..	..	..
Specific gravity 25° C.	1·084	1·120	1·288	1·282	1·123	1·091	1·146
Specific viscosity Engler	13·3 (100 c.c. at 25° C.)	24·5 (100 c.c. at 50° C.)	—*1	—*2	27·0 (50 c.c. at 50° C.)	18·4 (100 c.c. at 50° C.)	5·0 (50 c.c. at 50° C.)
Distillates: Per cent. by weight:							
Water	0·0	0·0	0·0	0·0	0·0	0·1	3·0
Light oils to 170° C.	1·3	1·1	0·5	0·6	0·6	1·2	3·0
Middle oils, 170–270° C.	31·1	17·5	3·0	3·4	23·4	20·0	20·0
Heavy oils, 270–315° C.	12·5	11·7	9·4	9·0	12·5	9·5	11·3
Appearance of—							
Middle oils	Clear	Clear	Cloudy	Cloudy	One-fourth solid	Clear	Clear
Heavy oils	Clear	Clear	One-eighth solid	One-fifth solid	One-fourth solid	Clear	One-third solid
Residual pitch	Hard, glossy	Hard, glossy	Hard, dull, brittle	Hard, dull, brittle	Fairly hard and glossy	Soft, sticky, semi solid	Hard, fairly dull, brittle
Free carbon in tar, per cent.	1·54	1·75	29·61	28·30	0·80	2·22	8·62

*1 Float test at 50° C. = 4 min. 18 secs. *2 Float test at 50° C. = 3 min. 33 secs.

World's Production of Petroleum in 1914.—The "Iron Age" (New York), giving statistics of the world's production of petroleum in 1914, taken from a return compiled by the United States Geological Survey, says that the quantity of petroleum entering the markets of the world in that year amounted to 400,483,489 barrels (of 42 gallons). Of this record output of oil, the United States is credited with the production of no less than 66·36 per cent.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Dublin Gas Company.

SIR,—Your correspondent, "Anticipant," appears to have correctly foreseen the financial position of the above Company, as it is now disclosed in the Directors' report.

While I have always read Mr. R. W. Edwards' ["Nonulus"] letters with profound interest, he may, having now seen the Directors' report, have views differing from those conveyed in his letter to you of the 9th inst. In the past, he has shown so much ability in dealing with the Company's affairs that I am content he should continue to exercise the same vigilance without my aid. It is quite true the form of the accounts has been changed, which makes comparisons difficult; but in view of the high standing of the Company's Auditors, we shall look forward to Mr. Edwards' comments of the accounts, as now presented, with added interest.

"Anticipant" seems to be of opinion that the primary cause of the financial disaster was want of administrative ability on the part of the Board of Directors, with which I agree. The balance-sheet now before me fully substantiates this view. It cannot be suggested that the enhancement in the profits has arisen through radical re-organization or additions to the works' plant, although doubtless something has been done under the able direction of the Company's Consulting Engineer, Mr. Newbigging. Time, however, has not permitted anything material being done in this respect; in fact, the accounts reveal £2200 only as having been spent during the past half year,

The point to which I venture to direct the shareholders' attention is the immediate future. The former Board of Directors have exhibited, as the comparison referred to shows, the most lamentable want of business capacity possible to conceive. They ran the Company's affairs on to the rocks, to which they were seen drifting for some years; but they refused to listen to competent criticism, until at last the crash came. The shareholders took command, and have in so short a space of time re-floated the concern in comparatively smooth water. Are the shareholders to continue to give their confidence to men who have acted in such a way, and shown such magnificent incapacity?

The additions to the Board, appointed at the shareholders' meeting in March, 1914, have (as ordinary business men would do) seen to the business administration of the undertaking with results which are gratifying. There is, doubtless, much that can yet be done in the vital equipment of the works, which will spell still greater economies; but I wish to emphasize the point that what has been lacking in the past is ordinary business capacity to administer such a trading concern, and that those who are left of the old directorate must be swept aside to make room for competent business men.

If it is not going too far, I would say that the administration of this Company has, in Dublin, been a byeword for years past; and it is not to be expected that competent business men such as Dublin possesses more than enough of, would be associated with men who have proverbially administered such an important service with such lamentable disregard of the shareholders' and the public interest; for not only have the shareholders lost, but the gas consumers of Dublin have paid tens of thousands a year more than they need have done, had the Company been in the hands of competent men.

If, therefore, the shareholders' and the consumers' position is to be secured in the future, some drastic steps will require to be taken between now and the meeting in March, when the re-election of the Directors takes place, to organize the shareholders, and make adequate provision for the future administration of the Company.

I was one who disapproved of the new Directors' policy of excluding from the Board men of proved gas experience; and while the showing is good so far, with their aid it would have been better.

The new Directors are silent as to the experts' report. How much has been carried out, and what yet remains to be done? They have not as yet appointed a competent man as Engineer and Manager of the works, such as all other companies deem it expedient to do.

How, therefore, can the shareholders have any confidence in a Board totally ignorant of the technical side of the business they are conducting, upon which the profits ultimately rest, and who seem to delight in relying exclusively on their commonsense business ability.

It is true the Board is being advised by a Consulting Engineer of eminence; but a Consulting Engineer is not the same as a General Manager and Resident Engineer, as all gas authorities know well.

The care which the Lancashire members of the Board have given to the Company's affairs is shown by the results they have achieved, and is some indication of the frequency of their journeys to and fro. It is not to be expected that they should continue indefinitely to devote so much time to the Company's affairs. Their shareholding interest is not large; and I would strongly urge very grave consideration being given to the future administration of the Company. The members of the old directorate still on the Board should have the grace to retire or be pushed out. Competent business men in Dublin should be added to the Board—sufficient in number to establish the Board on its statutory basis. The Board so constituted should procure the services of the best man they can lay their hands on, as Engineer and General Manager of the undertaking, resident in Dublin.

Given such organization, the future of the Company is assured. Alternatively, the exclusive policy of the new members of the Board, which they have shown some indication of pursuing, will assuredly run the concern again on the rocks in the course of a few years.

Sept. 17, 1915. FUTURIST.

Radiant Heat Distribution.

SIR,—With some reluctance, I return to this subject. The *crux* of the whole question is, as you appear to realize, which is the best for distributing "radiant heat"—the straight or rounded fire—for practical purposes. Whether you have grasped the real principles of radiation is not so apparent. You speak of "concentrated radiant heat." How radiation from a gas-fire, which disperses in straight lines and in all directions, can at the same time be concentrated (which, according to the dictionary, means "to bring to a common centre, point, or focus") is to me a scientific revelation.

Reverting to the point of what really does happen, and which has been the whole purport of my two previous letters, it is now apparent that your advocacy of the round-front has been based on a misconception of radiation principles. From your comments, it now seems that your advocacy has been based upon the assumption that the round-fronted fire will be used for "straight filled-in mantels and not recessed ones." I am glad you have assisted me to make it clear that there is no advantage in the round-fronted fires with ordinary fireplaces, as they are intended for fireplaces which would have to be specially filled in. You therefore concede my point [third paragraph, p. 591] that "increased area, by altering the design, is of little practical use in room heating with the big majority of modern room fixtures." Another point conceded is that circular fuel placement is not new. It has yet to be proved that the round-fronted fire gives an increased radiant efficiency.

With regard to air movements bringing out the products, it would appear that you have relied solely upon your senses, and not upon scientific tests. It is generally recognized that there is practically no smell in up-to-date gas-fires; but this in itself is not sufficient proof that products are not brought out.

JAS. W. WILSON,
(Wilsons and Mathiesons, Limited.)

Leeds, Sept. 17, 1915.

[Mr. Wilson this week plays upon words and assumptions. He appears to think that we have not grasped the real principles of radiation. Our friend is obviously readily persuaded by the processes of superficial reading and stripping words bare, which is not complimentary in controversy. What is the ground for his fancy regarding a deficiency on our part of knowledge as to the principles of radiant heat distribution? It is that (so he says) we spoke of "concentrated radiant heat," which, of course, we did not do. He goes so far as to consult a dictionary to assist in the work of unfairly representing our statement; and he finds the dictionary he referred to states the meaning of the word "concentrated" to be "to bring to a common centre, point, or focus." Our correspondent, for the purpose of making a point in argument, was blind altogether to the context of the word "concentrated" in our reply to his letter last week. Let us repeat what we said, so as to impress it better on his attention: "The real question is which is the *better distribution* for practical purposes—the *more* concentrated or the *more* distributed heat." We ask his particular observance of the italicized words used in connection with the word "concentrated." Among the lexicon meanings of "concentrate" we believe are: "To bring into closer union," "to bring into narrower compass," "to condense." We used the expression "*more* concentrated" (we will not insult Mr. Wilson's intelligence by assuming that he really thought otherwise) in a relative sense, as the word "more," we imagine, clearly shows, and precisely in the same way as our correspondent spoke, in his first letter, of the radiant heat from a straight-fronted fire "effectively warming anyone sitting in a chair on *any part of the hearthrug*." In the same way, too, as he stated, in his second letter: "Neither can you increase the radiation distribution area, unless the gas consumption is also increased to make good *the losses in the direction in which radiation has hitherto been regarded as most useful*." And again: "You must have a larger fire area, and therefore a larger consumption of gas, to get *in* the *usable part* of the room *the same amount of heat* as you get from a straight-fronted fire." Our correspondent must be thanked for providing the necessary illustrations to enable him to comprehend the meaning of "*more* concentrated" and "*more* distributed" radiant heat, in relation to "better *distribution* for practical purposes." Mr. Wilson also appears to contend that "recessed fireplaces" are "ordinary" ones. They do not happen to be so in the houses of the great majority of people; and the large number of gas-fires in use are set in front of a coal-grate (with or without the bars removed), or with the mantel filled-in as shown in the illustration on p. 445. Again, we will not insult our correspondent's intelligence by saying that this is news to him. With Mr. Wilson on one's track, it is evidently very necessary to be scrupulous as to terms, although he is not so. When we remarked on the "*new line*" of fuel placement, naturally there was no intention on our part of suggesting that no one had ever before tried a curved line of fuel placement. But the semi-circular placement has not been the normal line in gas-fires; nor have we ever seen it in a fire on the market (other than circular ones) with vertical fuel. The Richmond semi-circular fronted fire is, taken as a whole, new in design and certain structural features. With regard to air movements, and Mr. Wilson's statement that "you have relied solely upon your senses and not upon scientific tests," let us remind him of what we said on p. 494: "The point has, we know, been well in the mind of the firm in designing the fire; and it has been placed under *long test*." Therefore, we are not relying "solely" on our "senses"—our "senses" with ordinary straight-fronted fires are *plus* the "long test" with the semi-circular fronted fire.—ED. J.G.L.]

Benzol Recovery.

SIR,—In his article on "Benzol Recovery from Coal Gas," which appears in the "JOURNAL" for Sept. 14, Mr. W. R. Herring records the fact that by adding 5 per cent. of benzol to a washing oil, the drop in the illuminating power of the washed gas is smaller than when a non-benzolized oil is used.

It would be very strange if it were otherwise; but on what grounds does Mr. Herring conclude that the benzolized oil is suitable for use in a rotary washer? It would be useful to know how much of the toluene in the gas was removed by the non-benzolized oil, and how much by the benzolized oil. No figures relating to the amount of toluene extracted are given in the article, although this must be the deciding factor as to the suitability of the process.

Other gas engineers besides Mr. Herring have expressed astonishment at the small loss in the illuminating power of a gas stripped of its naphtha (so-called benzol). Yet this is only another illustration of the fact established many years ago by Professor Lewes, that the illuminating power of gas is by no means the sum of the illuminating power of its constituents.

Sept. 17, 1915. "IGNORATIO ELENCHI."

Training and Education of Gas-Fitters.

SIR,—Thanks, no doubt, to the wretched acoustic properties of the room in which the meeting of the North British Association of Gas Managers was held, your reporter has made one or two mistakes in his report of my contribution to the discussion on Mr. Cowie's paper which I should like to correct, as they made nonsense of what I said. The report reads that some excuse for the invitation which had been extended to me to take part in the discussion might be found in my connection "with the Metropolitan gas industry." This could hardly have been considered a valid excuse. The excuse that I tendered was my connection with the British Commercial Gas Association, which, as I remarked, was as much a Scottish as an English, Welsh, or Irish affair.

Then I am reported as saying that "during the last century those associated with the gas industry had exercised themselves in the protection and perfection of machinery and the article produced by machinery." If the word "production" is substituted for "protection" the report would be much more near what I actually said. The words "and protect" should be deleted in the next sentence; and three lines further down the words "gas supply" should be substituted for "gas inspection."

F. W. GOODENOUGH.

Sept. 14, 1915.

Supply of Thorium Nitrate.

SIR,—Will you permit us to correct the letter of Mr. M. H. Hersey, appearing in the "JOURNAL" for Aug. 25, in which he intimates that there is only one firm who can supply thorium nitrate. Since January last thorium nitrate made by this Company, averaging 48 per cent. oxide, has been offered in very liberal quantities to all English mantle manufacturers. We use monazite sand obtained in India, and manufactured by us into thorium nitrate in our own works in Chicago.

This Company is in no way associated or connected with any syndicate or trust. All raw material made by the Company is for its own needs primarily; but, incidentally, it may be mentioned that our capacity is such that we can manufacture large quantities of thorium nitrate to supply other manufacturers in this and other countries.

For the LINDSAY LIGHT COMPANY,
CHARLES R. LINDSAY, President.

Chicago, U.S.A., Sept. 8, 1915.

The War Bonus Question at Oldham.

There has been a sharp development of the war bonus controversy at Oldham between the Corporation and the members of the Gas Workers' and General Labourers' Union; and at a meeting of the Committee of the Oldham branch early last week it was decided to take a ballot of the men—the Corporation having in unmistakable terms twice previously refused to grant an all-round war bonus of 3s. per week. On the other hand, they made an offer of 2s. per week bonus; but this the men rejected. At the meeting referred to, Mr. J. R. Clynes, M.P., the General Secretary of the Union, reviewed the position of affairs [see "JOURNAL" for Aug. 29, p. 409], and said the decision to ballot the men had been arrived at because the Corporation had refused to consider their claims. The Committee had decided to issue ballot-papers which would be returnable by the end of this week; and the men would be asked to say whether they were in favour of the Union tendering notices to cease work in order to press their original claims for a bonus of 3s. With the ballot-papers a statement of the men's position would be given, in which it would be pointed out that the decision of the Corporation to give a bonus only to men receiving less than 30s. per week left out a large number who were doing the hardest work, and who had also to work on Saturdays and Sundays. Should the men decide to cease work, it will be necessary for fourteen days' notice to be given by those employed in the Gas Department (680) and Water Department (105).

Cardiff Gas Company's Gift.—The loyal action of the Cardiff Gas Company received warm recognition last Wednesday, when the local Technical Education Committee thanked the Company and Mr. George Clarry (the Secretary and General Manager), who is also a member of the Committee, for the gift of a well-equipped building suitable for conducting classes in munition work. The Superintendent of Technical Education (Mr. Charles Coles) presented a report, in which he remarked that it was through the kind offices of Mr. Clarry that the Gas Company had erected the building, and provided various necessary tools. Some 200 persons had registered for entry; and the classes commenced yesterday, on the shift system.

REGISTER OF PATENTS.

Production of Producer Gas from Bituminous Fuels.

DELLWIK-FLEISCHER WASSERGAS GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, of Frankfort-on-Main, Germany.

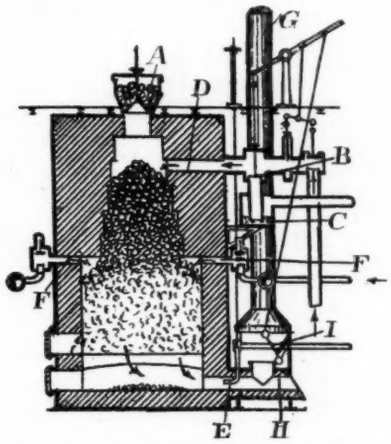
No. 303; Jan. 5, 1914. Convention date, March 12, 1913.

This invention relates to the production of gas from bituminous fuels in a producer in which steam and air are alternately forced through incandescent fuel.

It is already known, the patentees mention in their specification, that the industrial production of high-grade water gas from bituminous fuels (exclusive of coke, anthracite, or charcoal) by means of blast apparatus, encounters very serious difficulties, because the liberation of gas and the coking of the fuel which takes place in the upper part of the fuel column does not keep pace with the consumption in the lower part of the fuel column of the coke necessary for the production of the water gas. According to this invention, these fuels are used in generating a gas containing but little carbon dioxide, by arranging that in a producer through which air and steam are alternately forced—for example, operating according to the Dellwik-Fleischer process set out in patent No. 29,863 of 1896—during the period of gas liberation (that is to say, at the time steam is blown in through the grate) a current of air is blown in in the middle of the column, just sufficient in quantity to distil and coke the freshly supplied fuel at the top of the column. A part of the water gas produced in the lower portion of the fuel column is brought to combustion with this air, almost in the freshly-formed state, and consequently in an economical manner effects the coking of the upper layers of the fuel. Thus essentially air is blown into the generator not only during the blast, but also during the period of liberation of gas.

This operation of blowing in air during the period of liberation of gas, which in the usual kind of producers, through which steam and air are forced alternately, is prevented by a safety partition between the gas and the air passages, is free from danger in the present case, on one hand, because the air current is maintained uninterruptedly—that is to say, during both the blast period and during the period of liberation of gas throughout the producer—and, on the other hand, because the air-blast takes place at a point where material still glowing is situated, and therefore, in consequence of the efficient combustion, the production of explosive mixtures is impossible.

It has already been proposed in a water-gas process to introduce air during the injection of the steam with the object of obtaining a larger volume of poor gas of lower calorific value. This resultant gas would, in all probability, be a mixture of producer gas, water gas, and distilled gas; and its calorific value would be reduced by the nitrogen present incident to the manufacture of the producer gas. In comparison with continuously operating producers in which water vapour together with air enters the furnace in an uninterrupted current, and in which, when necessary, also secondary air is supplied in order to increase the zone of combustion as far as possible, the present process is said to have the advantage that a gas having a very considerably lower content of useless gases is produced.



Dellwik-Fleischer Bituminous Fuel Producer.

The illustration shows the position of the apparatus during the blast period.

The producer at the top, in the vicinity of the feed hopper A, has an exit D for the useful gas which is controlled by the valve B and passes to the receiver C. Further, the producer is provided at the lower end of the fuel column with a steam-duct E, and may be fitted either at the bottom or (as shown) at the top end of the producer with an air supply. In the middle of the column—preferably at the place where the water-gas producing fuel column (which consists of incandescent coke) ends—a tuyere F is arranged.

The apparatus works as follows: The blast period of the fuel column takes place so that the products of combustion escape from the bottom of the producer through the flue G. After the necessary temperature is reached, the steam-valve is opened, and the useful gas thus produced is passed through the tube D and the receiver C to the outside. In addition to the current of steam [and this is said to form the novelty in the present process], air for combustion is introduced into the furnace through the tuyeres F. In this way a part of the water gas is burned, and in consequence the temperature of liberation of gas is greatly increased, so that the mass of fuel which rests above the

column of coke is effectively and quickly coked; the hot water gas rising up from below.

The process affords, at the same time, "the possibility of particularly improving the recovery of ammonia with a very small accompanying reduction in the quality of the gas produced." By blowing in combustion air, the additional quantity of heat for coking the upper fuel column can not only be produced, but it is possible without further preparation to increase the quantity of the combustion air to such an extent that the temperature necessary for the liberation of gas can still be maintained when fresh and relatively cold steam serving as the necessary excess of steam requisite for the production of ammonia is introduced, together with the combustion air above the coke column.

Manufacture of Producer Gas.

DELLWIK-FLEISCHER WASSERGAS GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, and KOSTER, P., of Frankfort-on-Main, Germany.

No. 884; Jan. 12, 1914.

This invention is a modification of that described in patent No. 303 of 1914 [see p. 649].

The process described in the parent application presents, it is said, the possibility of improving more particularly the recovery of ammonia in a simple manner by means of quite a small decrease in the quality of the gas produced, because of the proposal to inject air into the furnace above the layer of coke in order to burn some of the combustible gas, and hence raise the temperature at this point to the necessary amount. The principle of the present invention consists in the fact that, on account of this air for burning some of the combustible gas which has risen through the producer, and which air is blown in above the layer of fuel which produces water gas, not only the amount of heat to be added necessary for effective liberation of gas from the upper layers of fuel can be produced (as explained in the parent application), but it is also possible to obtain without difficulty an excess of heat by a suitable amount of this air of combustion in order to fully compensate for the reduction in temperature due to the wetness and lower temperature of the steam injected. Thus the temperature necessary for the proper liberation of gas can be obtained even if near the air for combustion above the column of coke, quite fresh, and therefore relatively cold, steam is introduced in order to form the excess of steam necessary for the recovery of the ammonia.

The process proposed consists essentially in introducing secondary steam as well as air for combustion after the blast period, in addition to the usual steam jet, above the zone of coke producing water gas. This steam is added in such proportions by volume that, in consequence of the special temperature of the upwardly streaming water gas, together with the combustion produced by the introduction of air, such a temperature is obtained that the liberation of gas from the upper part of the column of fuel is completely effected. At the same time the loss of heat due to the introduction of the fresh steam is made up. Moreover, the use of steam with, or close to, the air for combustion has the advantage that only a friable slag can be formed up to the neighbourhood of the blast tuyeres.

Treating Spent Material from Gas-Purifiers.

BONNEAU, L. C., of St. Denis, and HASENFRATZ, V. E., of Levallois-Perret, France.

No. 10,780; May 1, 1914.

This invention relates to a process for the total extraction of the chemical products contained in the spent material from gas-purifiers. It is said to improve on the known processes in two respects: First, the extraction of sulphur; secondly, the transformation into prussian blue of the impure and insoluble ferrocyanide of iron, and which allows also, as in previously known processes, to recover all the ammonia contained in the materials treated.

Fig. 1 represents all the apparatus employed for extracting the sulphur and recovering the ammoniacal nitrogen; while fig. 2 (which is continuous with fig. 1) shows the arrangement of the apparatus for the preparation of the prussian blue.

The sulphur is extracted in a special digester by a suitable solvent—for example, trichlorethylene. The spent material is contained in the feeding hopper A, and is fed into the digester B, into which is run (at its upper part) the boiling solvent which has been condensed from the condition of vapour in the condenser C—the vapour coming from the reheater D. The solvent contained in the latter is heated by steam in a tubular heat interchanger E, passes through the crude mass contained in the digester, and flows through a filter into the reheater by way of a syphon pipe shown; so that the crude mass is soaked in the boiling solvent before the latter is distilled in the reheater. Here the sulphur remains while the vapour of the solvent passes to the bottom of the condenser and rises until it condenses, when the liquid of condensation falls immediately on the mass under treatment in the digester. In this way the solvent acts on the latter at the temperature of ebullition; the circulation being continued until the whole of the sulphur has been extracted. When all the sulphur has been dissolved, the reheater is still heated, but the solvent flowing from the condenser is passed directly into a reservoir F, to be used in a fresh operation. The free sulphur is removed from the bottom of the reheater.

The fact that the vapours of the solvent passing from the reheater enter at the bottom of the condenser, and consequently are not obliged to traverse it throughout, but are raised only until they are condensed and then fall immediately in the state of boiling liquid into the digester, of which the upper part communicates with the lower part of the condenser, is said to be a "new and very important feature of the invention, since it ensures that the solvent should always have the maximum temperature—that is to say, the temperature of ebullition—when it acts on the material under treatment; besides, the trichlorethylene is more active the hotter it is." It has been already proposed in the extraction of sulphur, the patentees remark, to use an extractor connected by a syphon with the heater and a condenser connected with both heater and extractor; but "the arrangement was not such as to ensure that the solvent acted on the material in the condition of a boiling liquid.

The sulphur having been extracted, the crude mass, which still contains a certain amount of solvent, is mixed with water (which flows into the digester through the pipe shown; and the mixture is passed

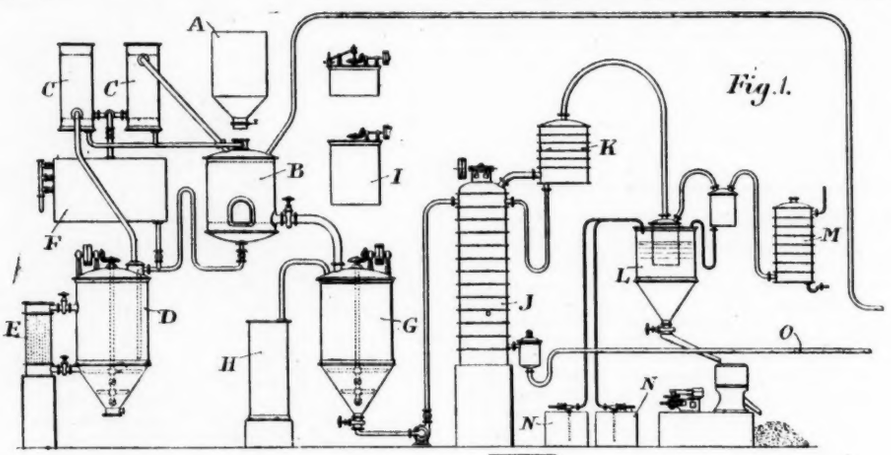


Fig. 1.

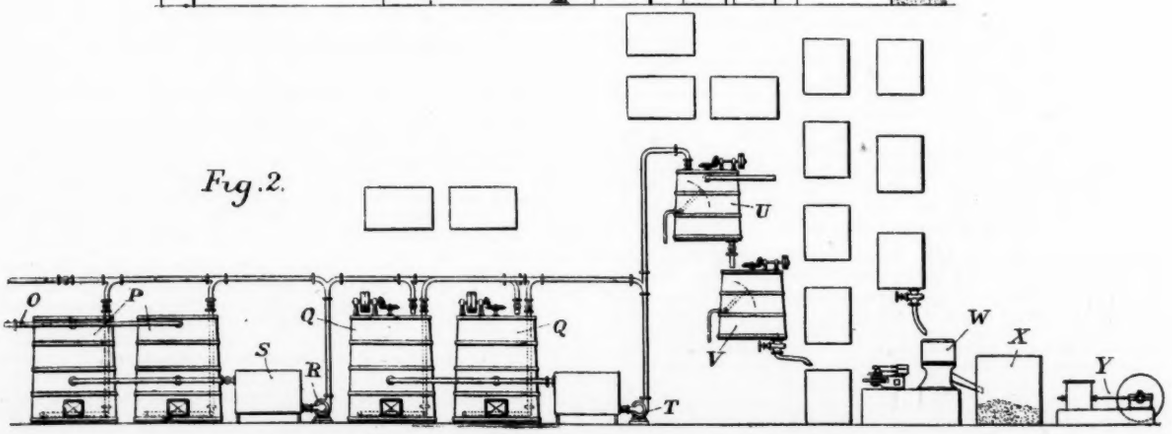


Fig. 2.

Bonneau and Hasenfratz's Treatment of Spent Material from Gas Purifiers.

into a mixer G (provided with a stirrer and heated by direct steam) connected with a condenser H, the purpose of which is the recovery of the trichlorethylene or other solvent still contained in the crude mass and expelled from it by the heating and stirring.

When this operation is at an end, the stirring is continued, and milk of lime, prepared in the vat I from lime contained in the vat above, is fed into the mixer. The milk of lime, on the one hand, liberates the ammonia contained in the ammoniacal salts, and, on the other hand, begins the operation having for its object the extraction of the blue by transforming the impure and insoluble ferrocyanide of iron into soluble calcium ferrocyanide, and thus eliminating all insoluble matter. The mass is heated to ebullition; a part of the ammonia distils, and when the transformation of the ferrocyanide is completed the whole mass is transferred by means of a pump into the column still J (provided with rotary plates), in which the distillation is conducted. The ammonia liberated is preferably first passed through another distilling column K and is then received in a sulphuric acid saturator L, where it is converted direct into sulphate. The sulphate is discharged from the saturator into a centrifugal drum, where it is dried and from which it is discharged as shown. The vapours not condensed in the condenser M are transmitted to the boiler furnace to be burnt. As to the residual solid material, when this has been re-oxydized it may be used again with advantage. At N are shown the reservoirs of acid and other liquor.

When the ammonia has been distilled in J, the contents of the still containing calcium ferrocyanide in solution are passed through the pipe O into vats P, where settlement occurs; and the clear liquid is conveyed to the further vats Q, which are provided with stirrers and are heated by steam. The water employed for washing the solid matter is used for mixing with the crude material in the digester B after the sulphur has been extracted from it. For this purpose the water is conveyed by means of a pump R. A reservoir S permits recovery of the water which has been used for the second and third washings.

The liquid contained in the vats Q is boiled, and then there is added a suitable proportion of potassium chloride, which has the effect of transforming the soluble calcium ferrocyanide into insoluble double ferrocyanide of calcium and potassium, which is rapidly precipitated. All the soluble matters are thus eliminated.

The liquid is decanted, and to the residue is added (together with an appropriate proportion of water) a suitable proportion of sodium carbonate—the mixture being boiled for some time. Double ferrocyanide of calcium and potassium is transformed into double ferrocyanide of potassium of sodium, which is soluble; while the lime becomes insoluble carbonate of lime, which rapidly settles. The vats containing potassium chloride and sodium carbonate are shown above the vats Q.

The clear liquid from these latter vats is conveyed, by means of a pump T, into a vat U, where it is mixed with sulphuric acid until the liquid is slightly acid. A suitable quantity of ferrous sulphate is dissolved in boiling water; and this solution is added, while boiling, to the double ferrocyanide. There is at once produced a white precipitate which is passed into a vat V, where it is peroxidized, by pure sodium hypochlorite or by hydrogen peroxide, so as to obtain prussian blue. The vats shown above are to contain sulphuric acid, ferrous sulphate, and sodium hypochlorite or hydrogen peroxide. The prussian blue discharged from the vat V is conveyed into one of the latter vats, where it is subjected to several washings by decantation. The blue is finally dried by means of a centrifugal drum W, and then passed into a stove X, where it is also subjected to the action of a vacuum produced by a pump Y.

In concluding their specification, the patentees remark: We are aware that it has been proposed to treat spent material from gas-purifiers with a volatile solvent to extract the sulphur, to add milk of lime to the residue, and distil off the ammonia, and to convert the calcium ferrocyanide solution into alkali ferrocyanide—for instance, by adding potassium chloride, and then treating the precipitated calcium potassium ferrocyanide with sodium carbonate; and they do not claim this process *per se*.

Incandescent Gas Flash-Light Apparatus.

SVENSKA AKTIEBOLAGET GASACCUMULATOR, of Stockholm.

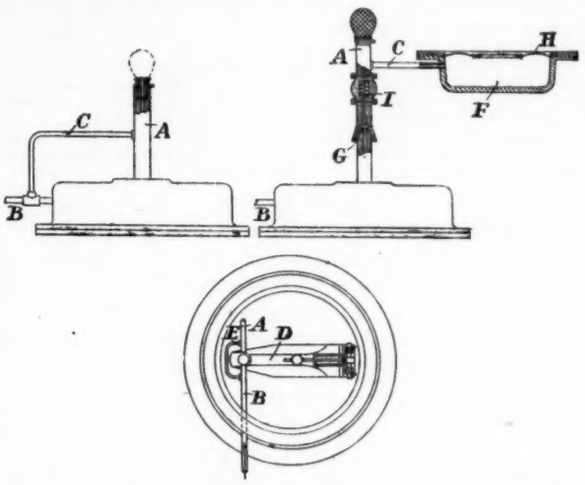
No. 17,569; July 24, 1914. Convention date, Aug. 1, 1913.

This invention has for its object to so construct the incandescent gas flash-light that the incandescent body shall be "more durable than is the case in the heretofore usual arrangements of this kind." In apparatus to which the invention relates, the patentees point out that the main flame is active a great number of times a minute, and the incandescent body is consequently subjected to great strain; moreover, to avoid any deposit of soot on it, the burner must always be supplied with "a completely combustible gas and air mixture in substantially unchangeable proportions."

Their proposal is for the pilot-flame to be dispensed with, and instead of it unequal amounts of a completely combustible gas mixture are supplied to the burner, so that at times a large flame is produced (putting the incandescent body into incandescence), and at other times a small flame is produced which is not able to make the incandescent body glow. Thus as a flame is always burning there is no possibility of an explosion each time the incandescent body is made to glow, and therefore the body will have a longer life than when a pilot-flame is employed.

Two arrangements embodying the invention are given; also a plan of the flash-light apparatus.

In the first the flash-light apparatus comprises an automatically working valve, which at certain intervals of time opens and shuts a conduit A leading to the incandescent burner. B is the pipe through which a completely combustible gas and air mixture is admitted to the flash-light. C is a conduit between the supply pipe and the burner conduit, constituting a bye-pass around the flash-light and supplying a smaller amount of gas mixture to the burner when the flash-light valve closes the supply to the burner conduit. When the valve again opens the burner conduit, a larger amount of gas mixture is supplied to the



A Swedish Flash-Light Apparatus.

burner, whereby the small flame, which at other times is burning, swells out to a full flame. In the burner, therefore, according to the circumstances, burns a small flame or a full flame, making the incandescent body to glow.

The desired smaller amount of gas mixture may be admitted to the burner when the incandescent body is not glowing, by so arranging the valve D of the flash-light apparatus as not to close the burner conduit completely, but allow a certain amount of gas mixture to leak through the valve, or the gas mixture may be led through a bye-pass E around the valve D.

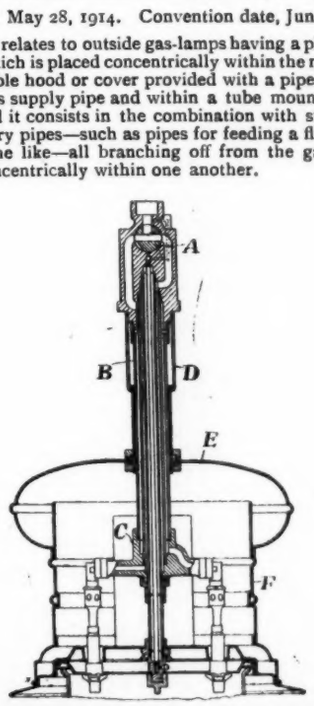
In the second construction, the smaller amount of gas mixture is supplied to the burner from a receiver F, which, by means of the conduit C, is connected with the burner conduit A. Gas is here led to the flash-light apparatus through the pipe B, and air for establishing complete combustion is supplied to the burner conduit through an opening G. The receiver F is closed by a diaphragm H, and the gas and air mixture is supplied to it from the burner conduit through the pipe C during the time the flash-light supplies gas to the burner-pipe A. When the flash-light apparatus closes the gas supply, a smaller amount of gas and air mixture flows to the burner from the receiver F through the conduit C, so that the full flame previously burning is diminished, and the incandescent body ceases to glow. A suction or non-return valve I in the burner conduit prevents the gas and air mixture from flowing out through the opening G.

Hoods of Inverted Incandescent Gas-Lamps.

JULIUS PINTSCH AKTIENGESELLSCHAFT, of Berlin.

No. 13,130; May 28, 1914. Convention date, June 6, 1913.

This invention relates to outside gas-lamps having a pilot burner, the supply tube of which is placed concentrically within the main gas supply pipe and a movable hood or cover provided with a pipe or tube sliding over the main gas supply pipe and within a tube mounted on the gas cut-off cock; and it consists in the combination with such a gas-lamp of several auxiliary pipes—such as pipes for feeding a flash-light and a night-flame or the like—all branching off from the gas cut-off cock and mounted concentrically within one another.



Julius Pintsch's Incandescent Gas Street Lamp.

The gas cut-off cock A is provided with an outlet at its lower end, which is as large as possible, and into which the main gas-pipe B is screwed. This pipe constitutes the support for the main parts of the

lamp and also a rigid connecting member between the cock and the gas distributing member C. A shoulder is provided at the lower part of the cock to which a pipe D is attached. The protecting hood E (which is provided with a tube which is dimensioned so as to telescope conveniently into the tube D) is rigidly attached to the lower cylindrical part of the outer lamp casing F, and, together with this lower extension, constitutes the whole hood or cover, which may be raised and lowered by sliding the tubes telescopically into and out of one another.

All the pipes branching off from the cock—that is, the pipes for the pilot flame and for feeding the various flames, such as the evening and night flames—are arranged within one another and inside the pipe D.

Production of Light Oils from Carbonaceous Substances.

ROLLASON, A., of Long Eaton.

No. 18,490; Aug. 10, 1914.

This invention is a modification of patent No. 19,697 of 1913, which related to a process for producing light hydrocarbon oils from coals, shales, and the like which are high in volatile matter and have a high oxygen content. The process was carried on at a temperature below 500° C., with approximately between 3 and 5 per cent. of limestone added to the charge in proportion to the oxygen content, "for the special object of limiting the formation of water vapour and increasing the hydrocarbon vapours evolved with the gases during carbonization of the charge—the fixed liquid products being recovered from the gases according to their boiling points."

The present invention relates to the distillation, at low temperatures, of carbonaceous substances—such as coal, cannel coal shale, and crude oils. It consists in their distillation in such a manner that, on the decomposition of the resinous matters contained therein, and during the period of distillation, condensable hydrocarbon vapours are formed, along with sufficient water vapour to prevent these hydrocarbon vapours from becoming overheated and converted into permanent gases or tar, "whereby an increased yield of light oils, of an improved quality, is obtained."

In carrying out the invention, the retort used may be of any approved type, preferably constructed of cast iron. [No illustration accompanies the specification.] The carbonizing space in the retort may be of any desired length or height; the width, in the case of retorts heated from two sides, varying from 3 to 6 inches, according to the density and conductivity for heat of the charge to be distilled.

The retorts are set in brickwork and arranged in such a manner that the materials used for their settings can take up a large amount of heat, and give it out, when required, to the retort during the distillation of the charge. The retort is preferably heated by gas, and so constructed that its temperature can be raised or lowered as desired.

The coal, &c., to be distilled, is crushed preferably below ½ inch diameter; and to the crushed coal or crude oil is added a small percentage of limestone—varying from 4 to 6 per cent. according to the density of the oils required to be produced, which range from ·9 to ·98. The charge while in the retort is heated up to a temperature of approximately 400° C., or it may be maintained at temperatures between 175° and 400° C., according to the density of the oils required to be produced.

The limestone added to the charge takes up heat at a low temperature during distillation and becomes slowly decomposed—liberating carbon dioxide, and leaving the calcium oxide in a nascent state. This now becomes chemically active and decomposes the organic matters and bases contained in the coal—thus liberating the gases which form water and hydrocarbon vapours. At this period an additional supply of heat is required, which is supplied from the brickwork settings; and this heat is utilized to supply the heat of formation of the hydrocarbon vapours formed from the decomposing matter and to raise the temperature of the water produced. The water vapour acts as a carrier for the volatile hydrocarbons, and as a preventative against their taking up heat and being decomposed into gases. The vapours after leaving the retort are condensed—"producing water and a large volume of crude light oils, free from tar, acids, or other objectionable compounds."

The crude oil is re-distilled; the vapours given off being conducted through a reheater and condensed under pressure into oils suitable for fuel and other purposes.

The patentee says he is aware that it has hitherto been proposed to obtain light oils from crude oils by passing the crude oil with steam over marble or equivalent material at a temperature (preferably) between 420° and 460° Fahr.; and he lays no claim to such a process in connection with his invention. What he claims as his invention is: "In the production of light oils, having densities between ·90 and ·98, from carbonaceous substances—such as coal, cannel, coal shale, and crude oils—introducing into the charge before distillation, approximately from 4 to 6 per cent. of limestone, proportionate to the maximum density of the oil required to be produced, and distilling the charge slowly at a low temperature below 400° C.; the charge also absorbing heat from the walls of the furnace during the period of distillation when water vapour and hydrocarbon vapours are formed—the water vapour acting as a carrier for the hydrocarbon vapours and preventing their decomposition into permanent gases and tar while in the retort."

Cooling Device for Ascension and Dip Pipes.

KILBURN, B. E. D.; a communication from MARCEL DE JONGH, the President of the Società Anglo-Romana per l'Illuminazione di Roma, and ALBERTO PACCHIONI, of Rome.

No. 20,276; Sept. 28, 1914.

This invention has particular reference to installations in which the gas, on its way from the ascension pipe to the hydraulic main or tar-receiver, passes through a pipe, cooled by a water-jacket, furnished with removable covers to allow of access for cleaning purposes. According to the invention, between the upper end of each rising pipe and the tar-receiver, a U-shaped gas-passage pipe is provided, the two limbs of which are separated by a partition and are enclosed in a jacket through which the cooling water is circulated. The limbs are rendered accessible at their upper as well as their lower ends by means of removable cleaning covers, so that although efficient cooling, and consequently thorough separation, of the tarry ingredients of the gas is ensured, owing to the comparatively long path which the gas has to travel, each portion of the jacketed gas passage pipe can be easily inspected and, if necessary, cleaned. The gas outlet pipe, whatever its shape and length, is connected to the corresponding hydraulic valve. All the valves of each furnace (with any number of chambers, each with a valve of its own) are mounted in a joint tank (tar-condenser) provided with lateral cleaning openings, and connected by a pipe and valve to the gas-collecting conduit.

Marcel de Jongh and Pacchioni's Ascension and Dip Pipe Arrangement.

Fig. 1.

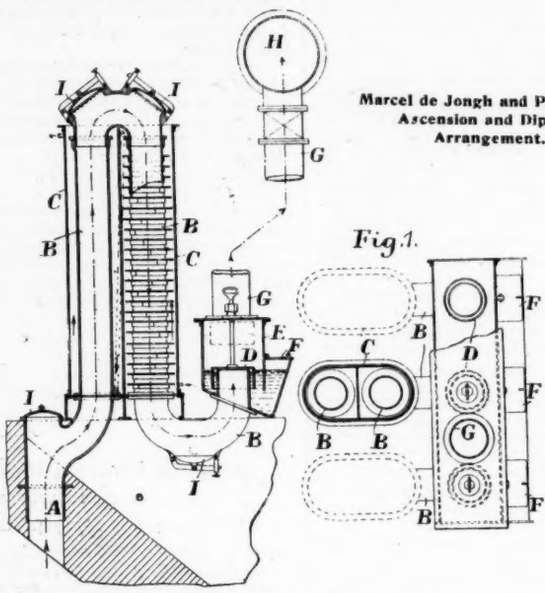
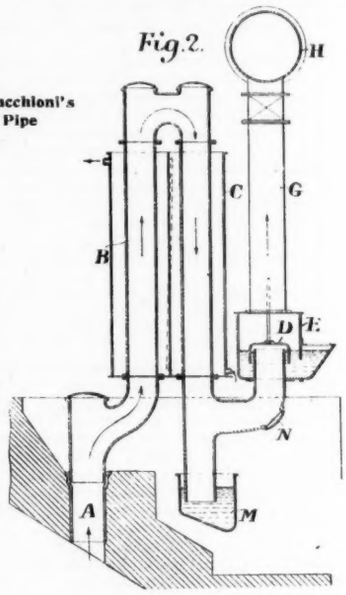


Fig. 2.



The construction illustrated is claimed to enable the following objects to be attained in a simple and efficient manner:—

1.—Strong cooling of the gas at the escape from the distilling or gasifying chamber.
2.—Separation of the thick tar from the dust and other particles mechanically carried away by the gas.
3.—Complete independence of one furnace chamber from the other chambers of the same furnace during the processes taking place in the chamber—emptying, loading, removal of slag, repairing, &c.
4.—Possibility of carrying out the distillation with a perfectly reliable and easily observed hydraulic seal.
5.—Perfect accessibility of the parts through which the gas passes before entering the gas-collecting conduit.
6.—Complete avoidance of any possible circulation of gas between the rising pipes and the distilling chamber.

In fig. 1 (a section and horizontal cross section of the plant), A is the single gas outlet of the distilling chamber, which forms the inlet into the cooling pipe B. C is the casing provided with cooling water supply and discharge devices and containing the cooling pipe, which may be furnished on the outside with ribs. D is the bell of the hydraulic valve; and E is the tank of the hydraulic valves with the cleaning boxes F. G is the connection pipe to the gas-collecting conduit H; and I are the cleaning covers of the pipes.

As the descending portion of the cooling pipe need, as a rule, be cleaned only at long time intervals, it is possible, the patentees remark, to adopt the arrangement shown in fig. 2, which consists in the cooling pipe being connected to the hydraulic valve by means of a T-pipe, instead of a 180° bend. In this way, any slight deposits falling down during the cleaning of the upper connecting pipe bend, or accumulating in the upper portion of the second (descending or dip) pipe, will fall direct into the tar-vessel M. On the bend N of the T-pipe could be arranged a small door, in order to inspect from time to time the interior. Similar doors are also provided at the upper portion of the cooling pipe.

SOME COMMERCIAL ASPECTS OF THE GAS BUSINESS.

The American Commercial Gas Association's Contribution to the San Francisco Gas Congress.

The programme of proceedings at the approaching San Francisco Congress of the American Gas Institute contains a "Symposium of Some Commercial Aspects of the Gas Business," contributed by members of the National Commercial Gas Association. As it is not likely that we shall have an opportunity later on of dealing with all the papers referred to, it may be well to reproduce some, at all events, of the abstracts as issued to the members of the Association in the current month's "Bulletin."

Orders and Complaints.

By W. J. CLARK, of Mount Vernon, N.Y.

Past-President of the National Commercial Gas Association.

The dominant factor in the development of our business, the author asserts, is what we call "good service." The question, therefore, as far as this paper is concerned, resolves itself into what constitutes good service in the operation of the order and complaint department, which in a gas company's organization comes most frequently into direct contact with the public, either in person or through the medium of the mail or telephone.

The man who represents the gas company at the complaint and order desk should be intelligent, well versed in the company's business, and of good appearance. He should be a man of experience, one who has a broad knowledge of human nature, and the ability to size-up other men. He should remember that in most cases he represents to the consumer the company itself, never for a moment forgetting the responsibility this entails.

From the point of view of the front-desk man in the company's office, there should be no such thing as an unreasonable complaint; for to the consumer the complaint is not unreasonable or he would not take the trouble to make it, and the order-desk man must learn to acquire the consumer's point of view. The consumer should not be permitted to believe that the company regards the matter as a complaint at all, but rather he should be made to feel that the gas company is obligated for the favour conferred upon it in having been given an opportunity to improve the "service."

There are other sources through which complaints may reach the company besides the personal interview at the office. Complaints that arrive by mail should be immediately acknowledged and passed over at once to the proper department for attention, and should be carefully and systematically followed up until the consumer has been entirely satisfied. Complaints by telephone should receive the same prompt and intelligent attention that is given to complaints by personal interview. It should always be borne in mind that the listener has only the tones uttered and the voice as it is conveyed along the wire, from which to form an opinion; and there is absent from the telephone conversation the gestures, facial expression, and the personality of the speaker —all of which weigh so much in a face-to-face talk.

Many consumers send complaints through the medium of other of the company's employees—collectors, fitters, &c. The belated delivery of these complaints, even if they receive immediate attention at the office, creates a bad impression of the company in the minds of the consumers, To encourage the prompt reporting of complaints, employees should be furnished with forms on which to report them; and the heads of the various departments whose men rub elbows with the public should ask for these forms each day.

The front-desk man should be on good terms with the heads of all the departments, in order to secure the best co-operation; and he should understand all about the operations of the shop, that he may be able to judge the sort of attention an order will receive, and form some idea as to the time that will be required to make the installation or perform what work is called for by the order. It is recommended that a working schedule, where practical, should be laid out and a copy of it kept within reach of the complaint or order-desk man, by which he can tell approximately when orders of certain classes can be reasonably expected to be completed.

Commercial Lighting.

By E. M. COLQUHOUN, of Philadelphia, Pa.

Member of the National Commercial Gas Association.

In the past gas has, it is pointed out, successfully met the competition of electricity, largely through its economy; but the old advantage of economy in operating costs that was formerly so beneficial to the gas industry does not exist to the same extent to-day.

Attention is called to the fact that, in addition to the increase in the efficiency of electric lamps, the cost of electricity for store lighting has been decreased in most cities by the adoption of the "demand system" of electric rates; and the comparative cost of gas and electricity for lighting is so much closer to-day than it has been in the past, that it is essential that more careful study be given to the details of the cost of operation for different classes of stores, if plans are to be devised that will successfully meet competition.

To increase the use of gas for commercial lighting, the cost of operation must be reduced. A more economical method of ignition is needed. The pilot consumption of the average store using the latest types of gas arc lamps is one-fourth of the total consumption. With some other reliable ignition system, the elimination of the pilot would give gas a tremendous lead in economy of operation over all competitors.

In the retention of the present gas lighting business, efficient maintenance service continues to be a dominant factor; and too much attention cannot be given to this subject by gas companies, both from the standpoint of improving the service and reducing the consumer's cost to the minimum. The service must be the best and the cost to the consumer as low as possible.

Industrial Fuel.

By F. W. FRUEAUFF.

Past-President of the National Commercial Gas Association.

We all are vitally interested, the author writes, in the development of the industrial fuel branch of the gas industry, because of the very profitable return now received, as well as the great possibilities offered by this field for large increase in the future. Industrial work was begun less than twenty years ago; and a very creditable success has already been attained in marketing this product in industries. Gas men are only beginning to realize the vastness of the field, and are slowly appreciating how unprepared they are to thoroughly invade it. Millions of dollars are spent each year for fuel oil that could easily be added to the gas companies' receipts if a few obstacles can be overcome.

The importance of having rates for large consumptions commensurate with these business opportunities is dwelt upon, because, without adequate wholesale rates, this business is practically excluded from our ledgers.

It is suggested that considerable thought be given to the proposition of manufacturing a gas of lower heat value, which can be produced and distributed at a less cost per unit of heat value than is now customary.

Attention is called to the unfortunate shortage of well-trained industrial salesmen. This condition is, no doubt, due to the failure of many gas companies to understand the real value of such men to their organization; and the positions have not been sufficiently remunerative to induce the proper men to enter this work.

One other rather serious drawback is explained—namely, the slowness in the development of highly efficient large appliances. This is attributed to the unusual expenses incident to perfecting large appliances—an expense the builders cannot entirely shoulder, because of the variety of these appliances needed.

It is suggested that a central development bureau be formed and supported by gas companies wherein large appliances, embodying new ideas of construction and methods of utilizing heats, can be perfected, in order that higher thermal efficiencies can be secured. This bureau would also solve some of the complex problems that will continue to arise as large fuel propositions are approached. The results of the bureau's work would be available to all companies contributing to its support.

The author, therefore, makes the following suggestions to the Congress, the carrying out of which is absolutely essential for the gas industry to reach its highest aims:

First. Lower rates for large consumption, and, if possible from a public policy standpoint, the producing of a gas that can be made and distributed at a much less cost than that now supplied.

Second. More thoroughly trained men, who receive a remuneration in keeping with the knowledge required and the results secured.

Third. The establishing of a central developing bureau to assist all companies in solving difficult propositions so that large consumptions can be taken on.

Commercial Policies.

By C. W. HARE.

The gas industry has ever been slow, the author points out, to realize the importance of the commercial side of its business; and it is due largely to the attitude of gas companies in the past towards the public that unusually intensive methods for promoting the sale of its product are necessary to-day. While the price of gas has been gradually reduced—sometimes voluntarily by the company, sometimes arbitrarily by city authorities—and while regulation by State Commissions, with authority to investigate and fix rates promising reasonable returns on capital has been a great step forward, it should be the policy of gas companies to make voluntary reductions in the price of gas when possible—thus avoiding a petition to the Commission by dissatisfied consumers. Only when it can be demonstrated that the price of gas cannot be reduced an additional cent with justice to the industry, should litigation be resorted to, and the fight made to the finish.

There is not an industry to-day which does as much free work for its customers as the gas industry; and the author sees, at no distant date, the time when the price of gas will be lowered to such an extent that some of the service, which has hitherto been rendered free of charge, must be paid for.

The majority of gas companies of the present day are as liberal in the extension of credit to their consumers, in the sale of gas and appliances, as any other up-to-date retail mercantile store. The offices are attractive and conveniently located, the advertising follows the best traditions of other retail establishments, and the best known methods are adopted to bring gas constantly to the favourable attention of the public.

To individual effort, however, should be added national effort, and this national affort can only be secured through a clear understanding that, unless the gas industry expends a portion of its energy for the good of the industry as a whole, it can never expect to gain to the fullest extent the benefit in its own community which it might otherwise gain.

It is not sufficient to feel that the work one is doing to-day is all that is necessary for the moment, without also considering what may be necessary a few years hence. Take time by the forelock; and if it seems essential that a new policy be formulated a few years hence to meet the then conditions, formulate it to-day. Do not pass on to your successors the burden of meeting conditions which it is your business to foresee and avoid.

Residence Lighting.

By W. A. Morris, of Wilmington, Del.

Commercial Manager of the Wilmington Gas Company.

Residence lighting is considered from the following five separate considerations:

1. The profitability of domestic gas lighting.
2. The advantage of domestic gas lighting over other illuminants and how best can the public be brought to appreciate the superiority of gas lighting.
3. What constitutes satisfactory domestic lighting for the various rooms of the average residence and what units are available?
4. The best practices for merchandizing this branch of our commodity.
5. Retaining residence lighting.

First: It is conservatively estimated that 2000 cubic feet *per capita* is a fair basis to estimate the possible revenue from the domestic lighting branch of the industry. It is shown that domestic lighting is now receiving greater competition than domestic fuel; and as the loss of business would not reduce the fixed charges, they should be entirely eliminated, or nearly so, from the consideration of profit in this branch of our industry.

Second: Dependability, economy, quality, and aid to ventilation are the advantages of gas lighting over other illuminants. Eminent authorities are quoted as substantiating this claim. A suggestion is made that these advantages be more widely proclaimed by local and national publicity, so that the public will become more thoroughly convinced.

Third: The following table gives a minimum amount of illumination required for the various rooms of the average residence. There are a number of available units which fill the requirements in the various rooms, the selection of which is largely a matter of taste.

Minimum.

Size of Room.	Total Candle Power of Lamp. Small.	Average.	Large.
Parlour	80	80	100
Dining room	80	100	120
Kitchen	60	80	100
Pantry	40	40	40
Living room	100	150	200
Reception hall	40	40	40
Porch	40	40	40
Music room	100	120	140
Library	80	120	160
Sewing room	40	80	100
Bed-room	60	100	140
Bath-room	40	80	80

This table is for light walls and ceilings, and direct lighting with fairly good reflectors of the usual residence type. For dark walls, increase specifications 25 per cent. For semi-indirect lighting, which, of course, requires light ceilings, double the figures given for direct lighting.

Fourth: More elaborate displays of modern lighting fixtures are urged for gas companies and more concerted efforts to encourage the manufacturers of higher-grade fixtures and more efficient burners. It is shown that liberal advertising policy has been a success in convincing the public that modern gas fixtures can be obtained as ornate as electric fixtures.

Fifth: It is claimed that the success of any enterprise depends largely on the satisfaction that its customers receive; and the only means of customers receiving continuous satisfaction is by a system of maintenance of residence lighting by the various companies. The modern gas-burners are somewhat complicated, and subject in recent years to numerous improvements; and the public cannot be expected to trace their troubles to improper burner regulations and know just what to do to remedy them. They therefore often find fault with the quality of the gas, or condemn modern gas lighting as impracticable, which condition can only be eliminated by well-organized and systematic maintenance.

In conclusion, the following paragraph touches on the duty to the industry and to the public: "It must not be forgotten that we are entrusted with the future welfare of a commodity that is of great benefit to the public; and unless we use every effort to further the sale of gas for all its purposes, and acquaint the public with all its advantages, we are not fulfilling our duty to the gas industry and the general public."

Domestic Lighting.

By J. D. Shattuck, of Philadelphia, Pa.

The subject of domestic lighting in its relation to the gas industry is one of the most interesting as well as one of the most important problems of the present time; for it is a branch of the business which represents a large proportion of the gas sold in the United States, and is the most stable department of the gas business, in that it is least affected by depressed business conditions.

The installation of mantle burners only marks the beginning of the supplying of light in the most usable and advantageous way, for improved lighting may necessitate better and more attractive fixtures just as well as the more efficient production of light.

Following this must come a broad maintenance service. To secure the best maintenance results, one must get in touch with the burner itself—resulting in direct contact with the consumer. Every company should adopt a maintenance system which to the individual company will accomplish the most good for its particular requirements. The development period of this system will undoubtedly show a loss; but this is true of almost any business undertaking. Maintenance service, if properly organized, and systematically operated with a definite purpose in view, can be counted on to produce a return equivalent to, or greater than, the return on the same amount of money spent in advertising the subject and asking consumers to "tell us if their lights are not in condition."

Good lighting is a necessity in every home, and a necessity always finds a market. With this in mind let us, the author writes, go out with the determination to improve every lighting installation. This improvement will keep us in the lead in the artificial lighting business. It will reduce our worries and increase our sales. The American people of to-day desire results, and we can give them results.

Domestic Fuel.

By R. E. Slade, of Providence, R.I.

Past-President of the National Commercial Gas Association.

Domestic fuel appliances for the purpose of cooking are held by the author to be of the first importance to gas companies; and it is largely with these appliances that increases in gas sales have been secured. The manufacturers have brought out a great number of designs, so that there is a type of range adaptable to any kitchen.

While originally gas-cooking appliances were used only during the summer months, their use is being extended more and more throughout the year; and it will be largely through the greater use of gas-ranges in the winter months that increases in gas sales will be secured in the future. The only obstacle to their continued use during twelve months of the year has been that they do not heat the kitchen nor supply hot water. In the newer houses, this difficulty has been overcome by making provision to heat the kitchen from the central heating plant, and, by the installation of a coil in the furnace, hot water is secured at a minimum expense for household use during the winter months. In the summer, the gas water-heater forms an economical means of securing hot water. In a great many of the older houses, the existing heating plants are so small that they cannot stand the additional work of heating the kitchen and supplying hot water in winter; but, as the small furnaces wear out, it is to the interest of gas companies to encourage the installation of larger heating plants, for through this it will be possible to make the gas-range the standard cooking appliance throughout the year. Attention is called to the importance of the gas water-heater as a means of increasing gas sales, and to the fact that it seldom requires an additional expenditure for mains, services, or meters.

There should be increased activities in the sale of gas for heating purposes. While the exclusive use of gas for heating is only urged in localities where the cold season is very short or cold days occasional, they are extremely useful elsewhere as auxiliary sources of heat for the period before and after the season when the coal or coke heating plant is in use. In sections where the cold season is short, and the heating load added to the peak, it would be well to consider whether the amount of gas sold for this purpose carried profit enough to pay the fixed charges on the apparatus necessary to care for this peak, which is idle during the balance of the year.

Miscellaneous gas appliances have their special uses; and for any domestic purpose where fuel is required, there is a gas appliance capable of doing the work. Attention is called particularly to the garbage incinerator which is rapidly being developed, and to the gas-iron which has been perfected to a high degree within the past few years. While the gas consumption of irons is comparatively small, there is an indirect return from their installation, because they render unnecessary the retention of the coal-range for ironing day—resulting in increased use of the gas-range and water-heater.

Office Management.

By C. N. Stannard, of Denver, Colorado.

Past-President of the National Commercial Gas Association.

In general business, the office is the place for originating orders, receiving information, classifying and distributing it, and digesting the reports received from the various departments. If an efficient office is desired, one must have an efficient office manager; and a man to fill this position must be one of great tact, an organizer, and, above all, one with a naturally systematic mind.

In addition to an able manager, charts of the organization will prove invaluable in the saving of time and promoting smoothness of operation in the various departments. These charts should show the relation of the various departments to each other, the duties of each department, names of heads of departments, and other information—in fact, a graphic representation of the organization. These charts should be hung in convenient locations, and should be clearly understood by the employees.

Attention is called to the necessity of having an efficient means of internal communication in an office of any size. Such a system should encourage written communication from one member of a department to another because: First, written communications can be sent more quickly than the person to whom it is sent can be found and given verbal instructions; and, second, the written communications can be referred to at any time, and they prevent misunderstanding of instructions.

The arrangement of an office is an important feature. The application desk, cashier's desk, and other points for the public should be so located that the various displays must be passed in order to reach them. The display room is so important that the gas company should do, as merchants do in other lines of business, everything possible to attract the public to their stores. Special demonstrations are recommended for this purpose, as well as attractive window displays.

Discipline is one of the important factors in the control of an office; but it is of such a delicate and intangible nature that it is impossible to secure it by printed rules. Straight-from-the-shoulder talks are the best means to secure proper discipline; and the unruly members of a department who will not heed such talks must be replaced.

Standard forms should be used in an office wherever possible, for they minimize office labour, and it has been found by tests that clerks will do 50 per cent. more work on standard forms than without them.

Public Relations.

By Edgar N. Wrightington, of Boston, Mass.

Past-President of the National Commercial Gas Association.

It is only by active and aggressive methods of solicitation of business, combined with a sincere effort to perfect the service and give the customer the most for his money, that the fullest returns to the business

can, according to the author, be secured. Once the gas manager has convinced himself of the advantages of such business methods, it becomes necessary to transform the traditional feelings of the customer also. The way to do this is to make every customer feel that his patronage, however small, is of the utmost concern to the company.

If a complaint is made regarding any part of the service, the greatest deference should be shown to the point of view of the customer, and the utmost endeavour should be made to satisfy him. Unfortunately, the majority of the complaints are made regarding the size of the customers' bills, and in these cases the greatest tact is needed to prevent the customer getting the impression that the company has assumed an arbitrary and unreasonable attitude in refusing to give a rebate on the bill unless an error has been proved. A careful investigation by a competent inspector is advisable where complaints of high bills are received.

The maintenance of consumers' appliances is another factor in developing the "satisfied customer;" and attention is called to the necessity of establishing rates for gas that will permit the gas company to supply not only gas but also good service, which necessarily includes a certain amount of free maintenance of appliances.

The only way to gain the confidence of the public is first of all to merit it by square dealing, and then to take them into our confidence, give full publicity to all our dealings, tell the public how much we earn and how it represents only a fair return on our properties, and wherever there is a dispute over any matter, be as tactful as possible in handling it. This is the way to get that desirable asset—the satisfied customer.

Accounting.

By P. S. YOUNG, of Newark, N.J.

Past-President of the National Commercial Gas Association.

This contribution does not present an outline of accounting procedure or discuss accounting systems, but draws attention to the main functions of accounting—what it has accomplished in the past in the gas business, and what it may reasonably be expected to accomplish in the future; and it includes some suggestions intended to bring about a higher standard of efficiency in the accounting departments of gas companies. It emphasizes the importance of simplicity in accounting, and points out the essential qualities of an efficient system. The development of standardized methods and processes is advocated; and the proper selection and education of the accounting employee is urged.

LABOUR QUESTIONS AT THE BRITISH ASSOCIATION MEETING.

Two subjects—"Outlets for Labour after the War" and "The Relations between Employers and Employees"—of special interest at the present time engaged the attention of Section F (Economic Science) at the recent meeting of the British Association at Manchester.

Section G had a Committee appointed last June to investigate outlets for labour after the war. It consisted of Professor W. R. Scott (Chairman), Messrs. C. W. Bowerman, M.P., W. J. Davis, J.P., J. St. G. Heath, J. H. Seddon, E. D. Simon, Sir H. Rider Haggard, Sir C. P. Lucas, K.C.B., Sir C. W. Macara, Bart., Sir Sydney Olivier, Sir E. im. Thurn, Professor E. C. K. Gonner, and Professor A. W. Kirkaldy (Secretary). The terms of reference were: (1) To investigate into the replacement of men by women in industries during the war; (2) the permanent effects of this after the war; (3) the character and re-employment with respect to changes of taste and physique among those who have served with the forces and are disbanded; (4) to suggest means by which consequent unemployment may be counteracted or minimized; (5) the possibility of employing disbanded men on the land.

It was decided to deal with the first two items only by way of report; and to investigate those industries in which the extra employment of women since the war had been most marked, as well as those industries in which there were possibilities of an extension of women's work, with special reference to trades localized in London, Manchester, Leeds, and Birmingham. For this purpose a number of investigators were appointed, and reports have been issued dealing with a large number of industries.

Among the trades in which the extension of women's employment has been most marked are engineering and chemicals (explosives). It is pointed out that, after the war, this employment will decline in a large measure; and for this reason these industries do not come so much within the category of trades in which there is likely to be any considerable readjustment as between the proportion of male and female labour employed in peace times. Nevertheless there is a marked tendency in these trades for women to undertake, in normal times, work usually associated with men. The whole problem was discussed in all its aspects; and the general report concluded with detailed reports on various trades.

The gas industry, as such, is not classified; but a report dealing with chemicals appears. It states that there has been a steady increase in employment in the chemical trade from the outbreak of war. The number of women in explosives works, which on July, 1914, was about 8000 has considerably increased—being drawn from other branches of the trade wherever work was comparatively slack owing to lack of materials and from depressed trades. The division of male and female labour in the trade seems clearly defined, and there is practically no question of women working on processes previously done by men. In Birmingham much of the more scientific chemical work was carried on for the Government in the laboratories of the Municipal Gas Department. This work has recently been considerably increased, and has been transferred to the Chemical Department of the University of Birmingham. The numbers employed, therefore, have been added to not by the employment of women, but by the employment of lecturers and students of the University not otherwise engaged in the work of production. The employment of University women in the most skilled departments of the trade such as research does not seem as yet to have been considered by employers.

The second subject referred to—the relations between employers and employees—is one which, while more or less normal in England at all times, has been accentuated during the war, not unnaturally called for some attention. While the gas industry, *per se*, has not been an offender, a closely allied industry—viz., the coal miners—has been very much to the front, and it may safely be assumed that, although other industries have added their quota to the worries of Ministers in these troublous times, the coal mining industry has been the chief seat of unrest.

Professor W. R. Scott, in his Presidential Address to Section F, did not touch very deeply upon the problem, but clearly pointed the path of duty for every skilled, and indeed unskilled, man at the present time—viz., to assist, by steady and sustained industry, to help in providing, directly or indirectly, all the supplies which are required. This implies a sinking of our own individual grievances, which after all are trifling compared with the main point at issue.

Professor H. S. Hele-Shaw, in his address to Section G (Engineering), however, went much farther. Having mentioned Field Marshal von Moltke's recent utterance, that Germany's emergence from a dangerous position as regards the supply of munitions was due to Germany's extraordinary organization, which included not merely the adaptation of their factories for munition purposes, but capacity for work of the people and the patriotic spirit of the German workman, he proceeded: This brings me to consider what is probably the most serious feature in our national life to-day—viz., the relation of employer and workman. It is hopeless, as long as such ideas prevail which seem to do at present, to think of any sound organization of our industrial system taking place, because the interdependent parts are not arranged (and can never be arranged until we change radically) with respect to the whole. Now as one who has served an apprenticeship, who has taken his money weekly from a tin box with hundreds of other men, who has been a member of the Amalgamated Society of Engineers (in fact, was working as an engine fitter when a Whitworth scholarship made a college career possible), I am the last man to put this evil down entirely to the working man. I know individually he is just as capable of patriotism as any other class. Get him by himself, even the men whose strikes have caused such despondency in the minds of our Allies, and who have seriously jeopardized the very existence of the country, and you will find (except in the sort of case to be found in all classes of society) that he, as an individual, is willing to make sacrifices, and if necessary to give himself for his country. The truth is that the canker which is eating the heart out of our industrial life is due to an entirely wrong attitude of mind. For instance, however much we may sympathize with men who see a loss of employment in the introduction of labour-saving machines, some means should be found by which they can share the benefits to the State and to their employers by the introduction of such machines. I should like, if I had time, to say something about the marvellous organization of the Ford motor-car works in America, and how it has given the men a share in the returns of a great industry, and thereby induced them to work in a way that has enriched themselves, their employers, and their country. We have many splendid examples of this co-operation in this country. Again, the employment of women in the engineering industries has taken place in many directions owing to the war. The works with which I am associated could not have undertaken much munition work without it. Some steps should be devised by which this avenue of industry is not closed to women after the war, while justice is secured for the men alongside of whom they are working, and from whom they are in many instances learning mechanical skill. Again, the questions of piecework and overtime must be seriously considered by the State, and not allowed to become the subject of disastrous disputes. Once more there is the question of a standard wage. It is against the eternal laws of Nature to try and keep living beings at one dead-level of equality and merit—*i.e.*, it is against the law of the survival of the fittest. The trade unions have a great opportunity of placing their country and themselves in a leading position among nations if they will courageously grapple with a great problem by recognizing degrees of merit and corresponding degrees of payment. These are a few of the many matters which must be dealt with in the immediate future. The matter of labour disputes is so serious as to demand plain speaking. It must be admitted that there are many employers and companies which, to satisfy themselves and their shareholders, extort the largest possible dividends and pay the smallest possible rate of wages, and do so apparently without the slightest idea that the men and boys under them are capable of education and personal influence. Can it be wondered then that men under these conditions are willing enough to listen to the orator who merely appeals to their fighting instincts and join in the game of grab as against the employer. On the other hand, strikes have occurred when employers have honourably carried out their obligations and undertakings, and the men have shamefully departed from an agreement made by their chosen leaders—throwing over the leaders the moment they have fancied it to their own selfish interests to do so, and without a single thought of their duty to the community as a whole. We have recently seen the Prime Minister and other leading statesmen struggling sometimes in vain to bring large bodies of men to a reasonable state of mind. Is not this (and I speak without the slightest reference to party questions) a case of nemesis overtaking us for having in so many cases pandered to the selfish instincts of large bodies of men so as to secure votes, instead of sternly telling them unpalatable truths?

The Economic Science Section also devoted a whole day (less the time necessary for the delivery of the Presidential Address) to the question of industrial harmony. As was perhaps to be expected, it was somewhat unsatisfactory, and petered-out without any resolution being put. This is not, however, intended in any way as disparagement. Exigencies of the times no doubt kept away many who could have spoken on the practical side. Economists, employers, and workmen's representatives took part in the debate; but any attempt to deal with this complicated problem in a comprehensive way must be foredoomed to failure, owing to the varying conditions and necessities of every industry. One new difficulty which some foresee is that the men having become accustomed to the more remunerative war conditions will resent the reversion to the old order after the war is over—advances made now by way of war bonus it will be desired to retain for all time.

SULPHATE OF AMMONIA PRODUCTION IN 1914.

Statistics by the American Coal Products Company.

Inasmuch as the principal European producers are engaged in warfare, it is, for the first time for many years, impossible to discuss the world's production of sulphate of ammonia from a basis of actual figures—statistics for Europe being obtainable to only a limited extent.

With this explanation, the American Coal Products Company, of New York, open their report upon the production of sulphate of ammonia in 1914 [which supplements in some respects Messrs. Bradbury and Hirsch's review of the market which was dealt with in the "JOURNAL" for Jan. 19 last]. They are, however, able to report definite decreases in the year's output of England and the United States, due to the war conditions existing in the last half of 1914; while in Germany it seems almost certain that a probable increase in the first half of the year was more than counterbalanced by a heavier decrease due to disturbed conditions in the last half. The production in Belgium was practically eliminated for the last half of the year, and presumably suffered in France for the same period. On these data, their estimate of the world's output is nothing more than a guess; but it may be hazarded at about 1,300,000 to 1,350,000 metric tons, as against 1,409,000 metric tons in 1913.

As regards the prospects for 1915, the report says it is quite probable that, contrary to expectations, there will be an increase rather than a further decrease. Modern explosives require the production of benzol, toluol, and ammonia; and these demands have brought the corresponding branches of bye-product recovery into strong favour. For this reason, existing plants will be operated at full capacity wherever possible; and the replacement of beehive by recovery coke-ovens has been to some degree encouraged. The demand for war munitions has reacted on the steel industry, both directly and indirectly; and there has been an increase in production, which brings with it an increase in coke and ammonia. This is true of the United States and of England; and in Germany it is reinforced by the need of benzol as a motor fuel and of sulphate of ammonia as a fertilizer—the latter to replace the nitrate of soda hitherto imported. With the prospect that business will be good until the close of the war, and possibly longer, it seems not unreasonable to expect that the ammonia production will increase correspondingly.

SOURCES OF PRODUCTION.

The bye-product coke-oven, the report goes on to say, still continues to be the main source of ammonia recovery, and the one that promises the most extension in the immediate future. Coal-gas works stand next in total output, though much greater in number, and more widely distributed geographically. The bye-product recovery gas-producer, the shale oil distillation process, and the English blast-furnaces using splint coal, are also responsible for a certain amount annually. Some is obtained from the carbonization of bones, and from peat—there being two Italian plants reported as operating on this material.

The methods by which atmospheric nitrogen is transformed into ammonia—viz., the synthetic process of Haber and La Rossignol—and the manufacture of calcium cyanamide, afterwards treated to liberate ammonia, appear to have been extensively pursued in Germany, because of the needs of war and agriculture. So far the Haber process has not been introduced elsewhere; but the production of ammonia from cyanamide has been carried on in Germany and Italy, and to a limited extent elsewhere. It is both interesting and significant to note in this connection that a Bill has recently been introduced in the German Federal Council to create a nitrogen monopoly in Germany extending to 1922.

Commercially, the season of 1914-15 was one of hope deferred rather than of fulfilment. The unfavourable prospects at the close of 1913 were adequately realized in a market that sagged continually throughout the first half of 1914. Towards the close of the year, however, more favourable conditions began to prevail, and prices had an upward tendency; but the monthly English quotations have averaged from £1 5s. to £2 10s. below those of the previous year; and the average for the year is £2 lower.

PRODUCTION OF THE UNITED KINGDOM.

The production of sulphate of ammonia and its equivalent in the United Kingdom, as reported by the British Alkali Committee, amounted to 426,412 gross tons; there being therefore a shortage of 6200 tons compared with the output in 1913. The cause of this reduction is, of course, the war. Examination of the separate items shows that the gas-works have lost most heavily, the iron-works quite considerably, and the shale-works a small amount. Part of these losses was neutralized by a substantial gain in the bye-product coke-ovens and a slight one in the producer and carbonizing works. The consumption of ammonia in all forms, reckoned as sulphate, is estimated at 106,000 tons in 1914—an increase of 9000 tons over 1913. The average price of the 24 per cent. grade at Hull for the year 1914 was £11 7s. 1d., as compared with £13 7s. 8d. for the year 1913. The English exports in 1914 were 313,877 tons, or nearly 12,000 tons less than in 1913, which, in the circumstances, is not surprising.

THE GERMAN OUTPUT.

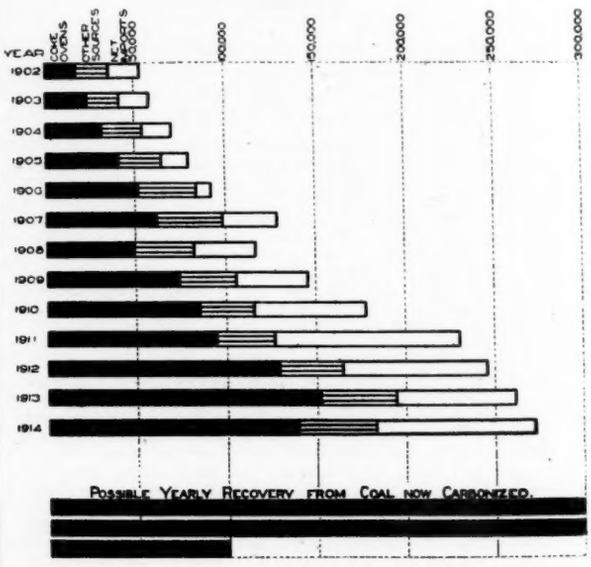
There are no figures at hand to indicate whether or not the German output of 548,560 tons in 1913 was exceeded in 1914. So far as can be judged by trade conditions, there was an increase in the production during the first half of the year, though the demand for coke was not really active.

The annual report of the Deutsche Ammoniak-Verkaufs-Vereinigung states that the beginning of 1914 did not reveal favourable conditions for the disposal of sulphate of ammonia. In spite of the reduction in price made toward the end of 1913, a large quantity still remained unsold at the end of the shipping season—*i.e.*, the spring of 1914. In the foreign market English competition made itself strongly felt. In addition to this, other nitrogen carriers were freely offered. Though early in 1914 Japan and especially America unexpectedly made their appearance as buyers of respectable amounts for spring delivery, the market was not steadied. The supply was in excess of the demand. Under these influences, the English quotation fell continuously from M.24·35 per 100 kilos. at the beginning of January to M. 20·35 at the end of May. During this time, exports amounted to 67,000 tons, as against about 38,000 tons for the same period of 1913. The outbreak of war at the beginning of August did not notably affect the market. Uncertainty prevailed; and it seemed probable the lack of skilled labour would prevent the saving of the partially gathered harvest, as well as hinder adequate and timely planting in the spring. Doubt as to the progress of the war paralyzed action. In Germany, this feeling soon gave place to confidence; and careful examination of the new conditions brought the conclusion that, with the restriction in the imports of Chilian and Norwegian nitrates, there would soon be a scarcity of nitrogen in Germany. The inquiry for sulphate of ammonia became active, and offerings were not adequate. The middleman's prices rose to such an extent that the Government intervened, and, with the co-operation of those concerned, established maximum prices. In consideration of the fact that the war made a reduction of price unnecessary, and further that the manufacturing costs had been increased, the Vereinigung were able to make arrangements with many of their customers to cancel the price reduction agreed upon. For this reason, the reduction was but little felt. At the end of September, the Government of Germany prohibited the exportation of nitrogen. Previous to this circumstance, the export business in 1914 had been steadily increasing.

The total disposed of for the year by the Vereinigung was 413,837 tons, as against 335,232 tons in 1913. On Dec. 14, 1914, the official maximum price for sulphate was fixed at M. 27 per 100 kilos. for 25 per cent. grade, and M. 27·50 for the dried and ground, analyzing 25·5 per cent. ammonia in quantities of 5 tons or over, including freight to districts adjoining and west of the Elbe, excluding cost of sacks. On June 1, 1915, these prices were advanced to M. 30·50 for the 25 per cent., and M. 31 for the 25·5 per cent. According to the official returns, Germany exported 75,868 metric tons of sulphate of ammonia in 1914, and imported 34,628 metric tons.

THE UNITED STATES.

The production of the United States in 1914 was only 183,000 net tons of sulphate and its equivalent—less by 12,000 tons than in the year before. This reduction came mostly in the last half of the year, and was due to the influence of the European war on the iron and steel trade. Had business kept the pace of the first six months, there would have probably been a small increase over 1913, in place of a deficit. Of the 183,000 tons produced, 139,500, or 76 per cent., are chargeable to the bye-product coke-ovens, and the balance to coal-gas works, bone carbonization, and other sources.



UNITED STATES PRODUCTION, NET IMPORTS AND CONSUMPTION OF SULPHATE OF AMMONIA AND SULPHATE EQUIVALENT,

Together with estimate of the amount recoverable annually from the coal now made into coke. Net ton = 2000 lbs.

The addition to the bye-product coke-ovens for the year 1914 included 41 Semet-Solvay ovens at Indianapolis, 27 Gas Machinery Company's ovens at Johnstown, 120 Koppers ovens at Sparrows Point, and 18 Wilputte ovens at Joliet. Besides these, 224 Koppers ovens at the Bethlehem Steel Works and 56 for the Laclede Gas Company at St. Louis went into operation—the former early in 1915. Construction of 100 Otto ovens at Buffalo is held up by the war. An addition of 20 ovens to the Inland Steel Company's plant at Indiana Harbour, went in during January, 1915. New plants expected to come into operation during 1915 include the Chattanooga Gas and Coal Products Company, 12 Roberts ovens; the Youngstown Sheet and Tube Company, 204 Koppers ovens; and the Minnesota Steel Company, 90 Koppers ovens. Additions comprise 92 Koppers ovens to the Republic Iron and Steel Company's plant, and a reconstruction of 120 ovens for the Allegheny Bye-Product Coke Company.

The consumption in the United States amounted to 272,000 tons, in round figures, as against 262,000 tons in 1913, an increase of 10,000 tons, showing that consumption progressed, even if production halted temporarily. The average price for the year is $54·20 per net ton, less by $8·66 than in 1913, and by $11·37 than in 1912. While the average indicates the condition of the market for the year fairly well, the

pendulum has now swung upwards again; and under the influence of the short home supply and the high freights from England, it seems bound for new high levels.

FRANCE.

Unfortunately, the figures for the sulphate of ammonia production of France for 1914 are not available, though it is reasonably certain that the total is less than the 74,500 metric tons produced in 1913, because of the general stagnation of industry arising from war conditions. Imports for the calendar year 1914 are officially given as 9274 metric tons, and exports as 2077 metric tons.

JAPAN.

Japan, as in past years, remains the largest single customer of England, taking 87,776 tons, though not as much as in 1913. The total imported is given by a United States consular report as 117,368 tons for 1914. The figures for production for 1913 and 1914 are not yet available.

FACTORY AND WORKSHOP LIGHTING.

Appendices to the First Report of the Committee.

Further notes are given now from the appendices which accompanied the first report of the Home Office Departmental Committee on Lighting in Factories and Workshops. Some of the appendices were similarly dealt with last week [p. 596]; while one of the more important from the point of view of readers of the "JOURNAL" will be found reproduced *in extenso* on pp. 643-5 of this issue.

ACCIDENTS IN FACTORIES.

In a memorandum prepared by the Joint Secretaries of the Committee [Messrs. D. R. Wilson and C. C. Paterson], it is stated that, in order to discover the relationship (if any) between working with artificial light and liability to accident, use was—on the suggestion of Mr. L. W. Thomas, of the Statistical Branch of the Factory Department—made of a special return of all reported accidents for 1913 and part of 1914. In this return the numbers were tabulated, for a large number of industries, of accidents occurring each month from various causes. From this return industries were selected for study, on account of the uniformity of conditions prevailing, special liability to accident, or large size of the industry. In the first place, diagrams were prepared showing monthly percentages of accidents due to the different causes, and for each month the relative number of accidents from these causes. Diagrams based on the first-named plan [which takes no account of the number of working hours or of persons at work each month], indicate a general drop for August, and in many instances a sudden rise in October, for some reason difficult to explain. On the second plan, the effect of the variations in the number of persons working and the number of working days is eliminated; but the true character of the curve may be masked by changes in the number of accidents occurring in the industry from causes other than that under consideration. The diagrams based on the second method possess, generally speaking, no characteristic form, except for accidents due to persons falling. The tendency of these particular curves [apart from building construction and docks] indicates an increase during the winter months of accidents due to this cause. In the general engineering industry, the curve showing accidents due to persons falling indicates a maximum number of accidents from this cause in January and a minimum in May. A curve dealing with all the industries demonstrates that in May 11·5 per cent. of all accidents were due to falls, as compared with 14 per cent. in January.

Another method was also pursued, based on certain assumptions, in which an attempt was made to calculate the normal accident rates from each cause during the months when no artificial light is used, and, by applying these rates to the daylight period of employment during the winter months, to estimate the accident rates during the use of artificial light. The hours adopted are such that for practical purposes no artificial light conditions obtain from April to September inclusive—that is, five months, excluding August, which is ruled-out on account of holidays. The average number of accidents per hour during this period is taken to represent the accident-rate per hour under daylight conditions only. General holidays are allowed for; and it is assumed that artificial light conditions obtain from half an hour before sunset to half an hour after sunrise. For all industries except engi-

TABLE I.—*World's Sulphate of Ammonia Production.*

(In metric tons of 2204·6 lbs.)

Country.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.
England	294,170	318,400	330,450	354,747	373,590	391,160	394,540	439,565	433,259
Germany	235,000	287,000	313,000	330,000	373,000	418,000	492,000	548,558	..
United States	68,000	90,120	79,500	96,600	105,143	115,245	149,700	176,900	166,016
†France	49,100	52,700	52,600	53,600	56,000	60,000	68,500	74,500	..
†Belgium and Holland	30,000	*55,000	§35,000	§40,000	§43,000	§43,000	§55,800	§53,600	..
†Spain	10,000	‡12,000	..	12,000	9,000	..	§9,000	§15,000	..
†Italy	5,000	11,000	§80,000	12,000	12,000	§166,500	§15,000	§15,000	..
†Other Countries	40,000	65,000	..	§73,000	§79,000	..	¶68,800	¶86,100	..
Total	731,270	891,200	890,550	971,947	1,050,733	1,193,905	1,253,340	1,409,223	

* Including Norway, Sweden, and Denmark. † Estimates from l'Engrais. ‡ Including Portugal. § Estimates from Deutsche Ammoniak-Verkaus Vereinigung, 1907-9 10-11-12-'3. ¶ Estimated.

TABLE II.—*Production of Ammonium Sulphate and Sulphate Equivalent from Bye-Product Coke-Ovens and Gas-Works in Germany.*†

(In metric tons of 2204·6 lbs.)

	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.
Coke-ovens	152,000	168,000	..	257,000	..	270,000	313,000	351,000	..	475,558
Gas-works	21,000	22,000	..	*30,000	..	60,000	60,000	67,000	..	73,000
Total	173,000	190,000	*235,000	*287,000	*313,000	*330,000	*373,000	*418,000	*492,000	*548,558

* Deutsche Ammoniak-Verkaufs-Vereinigung, 1906-07-08-09-10-11-12-13. † Dr. N. Caro, Zeit. f. angew. Chem., Sept. 14, 1906.

TABLE III.—*United States Ammonia Production, Expressed in Sulphate Equivalent.*

(Tons of 2000 lbs.)

	1901.	1902.	1903.	1904.	1905.	1906.	1907.
Bye-product coke-ovens	15,279	18,483	24,098	32,653	41,864	..	62,700
Coal gas and bone carbonizing works	*14,000	*17,641	*17,775	*22,011	23,432	..	36,609
Total	29,279	36,124	41,873	54,664	65,296	*75,000	99,309
Per cent. from coke-ovens	52 p. c.	51 p. c.	57 p. c.	60 p. c.	64 p. c.	..	62 p. c.

	1908.	1909.	1910.	1911.	1912.	1913.	1914.
Bye-product coke-ovens	50,073	75,000	86,000	95,000	130,000	153,000	139,500
Coal gas and bone carbonizing works	33,327	*31,500	*30,000	*32,000	35,000	*42,000	*43,500
Total	83,400	106,500	116,500	127,000	165,000	195,000	183,000
Per cent. from coke-ovens	60 p. c.	70 p. c.	74 p. c.	75 p. c.	79 p. c.	78·5 p. c.	76 p. c.

* Estimated.

TABLE IV.—*Ammonium Sulphate and Sulphate Equivalent Produced in France.*

(Tons of 2204·6 lbs.)

	1909.	1910.	1911.	1912.	1913.
Gas-works, Paris and vicinity	14,000	17,500	19,600	20,600	22,300
Provincial gas-works	4,000				
Bye-product coke-ovens	22,800	26,000	29,000	33,000	37,500
Sewage disposal	11,300	12,200	12,000	12,000	12,200
Shale-works	900	1,600	1,900	2,900	2,500
Various sources	500				
Total	53,500	57,300	62,500	68,500	74,500

The following table gives the estimated quantity of sulphate of ammonia and its equivalent in other forms of ammonia consumed in the countries specified.

TABLE V.—*Sulphate of Ammonia Consumption.*

	*United Kingdom. Gross Tons.	†Germany. Metric Tons.	‡United States. Net Tons.	¶France. Metric Tons.
1900	65,000 ..	127,700 ..	§36,000 ..	49,000
1901	68,297 ..	168,000 ..	§43,700 ..	43,300
1902	63,750 ..	175,000 ..	§54,300 ..	53,300
1903	71,700 ..	172,500 ..	58,650 ..	53,900
1904	68,500 ..	200,000 ..	71,300 ..	53,800
1905	75,000 ..	213,000 ..	80,600 ..	56,380
1906	82,000 ..	229,500 ..	§84,000 ..	67,000
1907	87,500 ..	240,000 ..	130,000 ..	81,000
1908	90,000 ..	260,000 ..	117,700 ..	84,000
1909	87,000 ..	274,000 ..	§146,700 ..	78,500
1910	87,000 ..	350,000 ..	§178,300 ..	73,000
1911	89,000 ..	370,000 ..	§230,400 ..	84,000
1912	90,000 ..	425,000 ..	§246,100 ..	§91,000
1913	97,000 ..	460,000 ..	§262,000 ..	§95,000
1914	106,000 ..	— ..	§272,158 ..	—

* Messrs. Bradbury and Hirsch. † 1900-4, Chemische Industrie; 1905-13, The Deutsche Ammoniak-Verkaufs-Vereinigung. ‡ Compiled from statistics issued by United States Government. § Estimated. ¶ L'Engrais.

The report includes a chart showing the fluctuations in prices, over a number of years, of sulphate of ammonia and nitrate of soda and the price per pound of nitrogen in each.

neering, the hours of work are taken as ten per day, between 6 a.m. and 5.30 p.m. In the case of engineering, the hours are assumed to be between 7 a.m. to 5.30 p.m., with an average of overtime in 1913 for all workers of one hour a day, from 6 to 7 p.m.

The total number of accidents from all causes from April to September, 1913 [excluding August], was 73,387, or 61·3 per hour; and this, being the normal accident rate under daylight conditions, is the rate assumed to hold good during daylight hours in the winter months. In this way it is possible to deduce for each industry the accident rate during the hours of artificial light which obtain in the six winter months. The total number of accidents in this winter period was 92,265; and assuming the rate of 61·3 per hour during daylight, and allowing for the slightly different hours of work in the engineering trade, the division is 61,405 accidents during daylight, and 30,860 in the 393 hours of artificial light. Therefore the accident rate in all industries and from all causes in 1913, during the hours of artificial light, was 79 2 per hour, as against 61·3 per hour for daylight. This is an increase of 29 per cent. under artificial lighting conditions. With accidents in connection with machinery moved by mechanical power, the increase with artificial light is 18 per cent.; while the increase in accidents due to persons falling shows an increase of no less than 71 per cent. during artificial lighting hours, when compared with daylight. Thus, while in all cases there is an increase in the accident rates for the period of artificial lighting, the increase is specially marked in the case of accidents due to persons falling.

There was an attempt made to obtain data with regard to accidents in mines, in which, of course, work is carried on with artificial light throughout the year. Statistics which would enable this to be done were unfortunately not available. A return of fatal accidents in mines, differentiated as "surface" and "underground," is, however, published monthly; and collating these for 1912 and 1913 [though eliminating the figures for the months affecting the national coal strike and the great Welsh disaster], the fact emerges that underground, where the lighting conditions are uniform, the accident rate was less in winter than in summer. On the other hand, there was a marked increase in the rate for accidents occurring in winter on the surface.

Influence of Lateral Illumination on Visual Acuity.

A statement by Dr. J. Herbert Parsons, reprinted from the reports of the Royal London Ophthalmic Hospital, on the subject of the influence of lateral illumination of the eye on visual acuity, forms one of the appendices to the report. This influence, it is stated, is one of considerable practical importance. The disagreeable effects of a bright light in the field of vision are familiar to everyone; but the cause of the distress, and how far it is seriously deleterious to the eyes, are points which have proved difficult to discover. Theoretically, various factors come into play—such as alterations in the size of the pupil, alterations in contrast, and fatigue As regards contrast, if the light-source is screened from the test-object, but not from the eyes, the illumination and the objective contrast between the object and the background both remain unchanged. Subjectively, however, the conditions are altered. Owing to the oblique incidence of the lateral light, the media of the eye are flooded with light, partly transmitted through the sclerotic, as well as through the refractive media, and partly reflected from various refracting surfaces, and thus unequally distributed. The conditions are complex; and it is scarcely possible to foretell the effects.

After referring to the work performed by various experimenters in connection with the subject at different times, it is remarked that Cobb ["Amer. Jl. of Physiol.," 1911] has investigated the question with great care; and his paper is the best which has yet appeared. By an ingenious method of testing, he arrived at a number of conclusions—among them, that light from a bright source entering the eye reduces the visibility of an object the more, the brighter the source the lower the brightness of the object, and the smaller the angle subtended by the two, except that, when the test-object is very bright, lateral illumination may cause increased visual acuity. Under a condition imitating the worst practical state for reading—the light at 10° from the visual axis, equal illumination of the eye and test-object [black letters on white ground]—the reduction in visual acuity is negligible at any intensity of illumination. The retinal image of the light is a negligible factor in the depression of vision—at least, for angles of 15° and over—since, the other conditions being equal, it is indifferent whether the image falls on the blind spot or on sensitive portions of the retina. The depression of vision is due to light which, by reason of reflection or diffusion, partly from imperfect transparency of the eye media, is scattered over the retina upon, and near, the image of the object. Visual acuity behaves in general, but not wholly, the same with illumination of the eye from a lateral source, and a haze of light thrown over the rod-free central retina [subtending 2° in the visual field], with proportional variations in the light flux in the two cases. There is no parallelism between the depression of vision for detail, on the one hand, and discomfort and other visual disturbances classed under the head of "glare," on the other hand, resulting from a light-source in the field of vision. Finally, Cobb agrees with the contention of another investigator that the unpleasant feeling of dazzling and the disturbance of vision produced by dazzling, are totally different things, and need not necessarily occur to the same extent at any given time. The discomfort may be associated with the eye movements.

Since that time, Cobb has made a further series of experiments, when it was found that different individuals may show fairly wide differences in their vision of objects of very low brightness, both with and without bright surroundings. In spite, however, of such individual differences, the relative changes in visual capacity caused by differences in surroundings were found to be, on the whole, in the same direction in cases of the same change in the conditions. For objects of relatively low brightness, the presence of a surrounding field of relatively high brightness has the effect of lowering the capacity of vision, both for detail and for brightness difference. In the case where the surrounding field was slightly brighter than the test-object, visual discrimination was found to be actually better, both as regards visual acuity and brightness difference than for a physically identical object seen in dark surroundings. Surroundings of a brightness about equal to, or less than, that of the test-object show no consistently better or worse results than dark surroundings with an identical test-object.

The succeeding appendix comprises an extract from a lecture by Professor Snellin, taken from the "Transactions of the Ophthalmic Society," nearly twenty years ago; and it is given as being of considerable interest historically. It records briefly work carried out with the object of answering the questions: "Is it possible to determine the minimum amount of light necessary to the workman with normal eyes for a certain sort of work?" And, further, "If such an amount of light is to be determined, is there a practical method to measure this amount?" In the endeavour to answer these questions, the following conclusions were arrived at: That in every workshop a minimum amount of 15 m.c. is necessary for work resembling reading, whereas a minimum of 10 m.c. will do for coarser work—like that of carpenters and blacksmiths; that in broad daylight the required amount is between 30 and 50 m.c.; and that it must be possible to exclude direct sunlight. Determinations of intensity can be done best by a Weber photometer.

(*To be continued.*)

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Directors' Report and the Accounts.

The report of the Directors of the Alliance and Dublin Consumers Gas Company, for the half year ended June 30, to be submitted at the meeting on the 30th inst., states that the accounts submitted show a profit on the revenue account of £59,340; and, after providing for interest on the debenture stock and temporary loans, there remains the sum of £50,471. The Directors have appropriated out of this sum £4083 in further reduction of the amount standing in capital account for ordinary and prepayment meters, and have placed to the credit of the special purposes fund the sum of £8119; being a contribution of 10s. per cent. on the capital of the Company for the year 1915. This leaves a balance of £38,268, to which must be added £12,145, the balance brought forward from last account, and a credit from income-tax account, amounting to £16, making a total of £50,429.

The Directors recommend the declaration of the maximum statutory dividend on the consolidated ordinary stock of the Company, at the rate of £5 2s. 6d. per cent. per annum, less income-tax. This will absorb a sum of £39,766, after which a balance of £10,663 will remain to be carried to the next account.

The Directors regret to have to announce the death, since the last half-yearly meeting, of their esteemed colleague, Mr. Richard S. Tresilian, J.P., and to state that Alderman Cotton, M.P., has resigned his seat on the Board.

The Directors feel confident that the shareholders will be very gratified with the results of the half-year's working, more particularly in view of the fact that since the commencement of hostilities they have not been compelled to increase the price of gas. On the contrary, in the Bray district, they have found it possible to make a reduction of 5d. per 1000 cubic feet, and, moreover, make substantial reductions in the price of gas used for power and manufacturing purposes.

The notice convening the meeting adds that (as special business) a proposal will be submitted "that a sum of £1000 be divided among the Directors resident in England as remuneration for their past special services to the Company; and that the sum available for the remuneration of the Directors be increased by the provision of a further sum of £500 per annum, same to be divided among the Directors resident in England."

Statements attached to the report show that the total amount of coal carbonized during the half year was 43,085 tons; that of 29,546 tons of coke made, as estimated, 13,018 tons (estimated) was used in manufacture; that of breeze made, to the estimated extent of 5563 tons, 3750 tons were used in manufacture; and that, while in December, 1914, the tar in store as estimated amounted to 283,736 gallons, there was produced during the half year 554,001 gallons, and sold 671,324 gallons. The amount of ammoniacal liquor in store in December, as corrected, was 432,481 gallons; the amount made during the half year, 1,162,810 gallons; the amount used, 1,398,651 gallons.

The gas made was 804,411,000 cubic feet (including 302,839,000 cubic feet of carburetted water gas); and the gas sold totalled 687,836,000 cubic feet, of which 37,723,000 feet were for public lighting, 650,113,000 feet for private lights per meter, and 12,824,000 feet were used at the works. The total quantity of gas accounted for was 700,660,000 cubic feet; unaccounted for, 103,751,000 feet. Public lights numbered 6331.

AUSTRALIAN GASLIGHT COMPANY.

The Annual General Meeting of the Company was held on Aug. 5—Mr. G. J. Cohen (the Chairman) presiding.

The Secretary (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report of the Directors for the half year ended June 30, an abstract of which was given in the "Journal" last week (p. 602), was taken as read.

Effect of the War on Extensions.

The Chairman, in moving the adoption of the report, said: When I last addressed you, I referred to several matters which were hampering the usual progress attending the Company's operations; and though some of these difficulties have since been overcome, there are others still remaining, which have to be contended with. The continuance of the war, for instance, so seriously interfered with the extensions at Mortlake that it was found necessary to ask that the period for vacating the head station be extended for another year, which has been granted. Consequently, the Company will retain possession of the property until the end of July, 1916. Owing to the impossibility of securing freight in England for shipment of the balance of the material required for the new gasholder now in course of erection, the work has been greatly delayed. For the same reason, No. 4 retort-house cannot be completed by the time first stipulated; but every effort is being made to have the new plant in working order as quickly as possible.

The Miners' Strike.

The miners resumed work at the "Pelaw Main" Colliery, Maitland, in

March last, after having been on strike for nearly ten months, during which period the Company experienced great inconvenience and loss, through having to obtain coal, in many instances of an inferior quality, at greatly enhanced prices, and increased freight, to enable the supply of gas to be maintained. Although the strike terminated in March, the normal deliveries of coal were not resumed until the end of June.

THE HEAD STATION.

With reference to the Company's claim for compensation for resumption of the head station, negotiations are still progressing, and it is hoped that a satisfactory settlement will be arrived at during the current half year. The delay, although unavoidable, has certainly caused the Company much anxiety, as the new works to replace the head station have had to be proceeded with without any portion of the purchase money being obtained. The delay in the completion of the new plant prevents the Company from receiving the profitable return naturally anticipated from the extension. The balance of the machinery required is now coming forward as expeditiously as possible.

NEW CAPITAL.

The Directors have decided that the time has arrived for increasing the Company's capital; for, apart from what may be received from the Government for the resumption of the head station, a large sum has been expended at Mortlake to meet not only the present but the future requirements of the Company's business. It is therefore proposed to forthwith dispose of 50,000 "C" shares, under the conditions contained in the Gas Act.

INCREASED BUSINESS.

This being the annual, as well as the half-yearly, meeting of the shareholders, I purpose comparing, in part, both periods of the Company's operations. Regarding the consumption of gas, the increase has not been so great as formerly, owing doubtless to the economy observed in domestic affairs, and a falling off in building operations generally, as the result of the present disastrous war. Compared with the corresponding half year, the increase in gas sold has been 72,615,000 cubic feet, and for the year 251,447,000 feet, which is equal to an increase of 7 per cent. compared with the previous year. This, in the circumstances that I have already explained, is satisfactory; and I trust the increase will be maintained. The returns from residuals also show a substantial increase this half year. The adoption by the City and Suburban councils of electricity for public lighting naturally lowers the Company's output of gas; but we are not materially affected thereby, as the lamps were supplied without regard to pecuniary benefits—a fact, I fear, not sufficiently made known to the ratepayers interested. The present number of public lights supplied by the Company is 7264. The number of gas-cookers sold during the year is 3298; the total disposed of by the Company up to the present time being 40,048, while gas-fires and other gas appliances have met with increasing sales. The number of consumers at the end of the year was 125,858—an increase of 6213 on the number reported at the last annual meeting. The length of mains and services laid during the same period, including the new 36-inch main from Mortlake to the Haymarket, was 160 miles making the total mileage to date 3238.

EMPLOYEES AND THE WAR.

The Directors, with the view of assisting those of the staff and the permanent employees who were desirous of serving the Empire, notified them that their positions would be kept open, and the difference between the military pay and their salaries or wages made up by the Company. I am pleased to say 97 have taken advantage of this provision. The Company have also promised assistance to the Commonwealth authorities in the production of material required in the manufacture of munitions, and have also donated £250 to the "Australia Day" fund, which I am sure meets with your approval.

THE DIVIDEND.

In reference to the dividend, I may add that the reduction on the "C" shares is consequent upon the increase in the price of gas, and is in compliance with the sliding-scale of the Gas Act. The "A" and "B" shares, as you are aware, have already been dealt with, and, consequently, are not affected on this occasion.

The report was adopted and dividends for the half year declared at the rate of 7 per cent. per annum on the "A" and "B" shares, and 6 per cent. on the "C" shares.

The retiring Directors and the two Auditors having been re-elected for another year, the proceedings concluded with a vote of thanks to the Directors and officers for their efficient services.

WIGAN GAS PRICE INCREASE.

The fact was recorded in the "JOURNAL" for the 7th inst. [p. 530] that at the preceding meeting of the Wigan Borough Council there was a debate regarding the extent to which it would be advisable to increase the price of gas. The Committee had agreed to recommend an increase of price for all purposes of 8d. per 1000 cubic feet; but some councillors argued that this was insufficient, and that the rise should be 9d. Finally, the Committee agreed to take the minute back for further consideration. Possibly it will be remembered that an outstanding feature of the debate was a declaration that, though in the past they had given money to the relief of the rates, as now constituted the Gas Committee had no intention of giving any more.

A special meeting of the Council was held last Tuesday, to again discuss the subject; and then the Gas Committee presented a minute saying it had been resolved that the price of gas supplied through ordinary meters for all purposes be increased 9d. per 1000 cubic feet; that the quantity of gas to be supplied through prepayment meters for 1d. be reduced from 30 to 26 cubic feet; and that, in the event of a net profit being made at the end of the present financial year, the price of gas be reduced accordingly. In the course of the subsequent debate, Mr. M'Curdy

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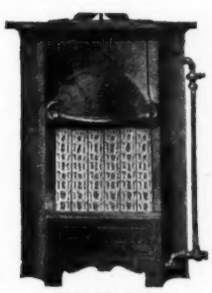

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WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
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expressed the opinion that the necessary increase in price was not the result of the war, but was due to the large amount of what he called "bogus profits" that had been paid over to the rates during the last thirty years. Before giving money to the rates they should sell gas at a reasonable price, and they should also see that the works were kept in a state of efficiency, which had not been done in Wigan. They would have to call in an expert; for the works had been starved of all mechanical appliances such as were to be found in up-to-date undertakings. They had power to create a reserve; but from 1883 to 1912 not a single halfpenny had been set aside for this purpose. The "plant" had been sacrificed in order to hand over large profits for the relief of the rates. The Chairman of the Committee to-day stood in the unenviable position of having to ask that the price of gas should be increased, chiefly on account of the unbusinesslike manner in which the undertaking had been carried on in the past. Alderman Fletcher and Mr. Alstead expressed agreement with these remarks; and Dr. Rees, speaking of the past, said he "looked upon the Gas Committee of Wigan as having been a lot of robbers more than anything else." The Mayor pointed out that the actual proposed increase in the price of gas worked out at about 7¾d. per 1000 cubic feet when the discount was taken off.

The Committee's recommendation, after other speakers had given their views, was agreed to.

RAILWAY CARRIAGE LIGHTING AND FIRES.

"A Fire was Inevitable" in the Gretna Train Disaster.

Reporting to the Board of Trade on the troop train disaster at Gretna, by which 227 persons were killed and 246 injured on May 22, on the Caledonian Railway, Lieutenant-Colonel Druitt, after reviewing the facts, says:

"Owing to the force of the collision, a fire was inevitable. I consider the cause of the outbreak in the main part of the wreckage was due to live coals from the overturned engine of the troop train; and this was afterwards intensified by the escape of gas from the cylinders as they burst. I consider that a fire would have occurred even if all the vehicles had been fitted for electric lighting, as a separate fire immediately broke out among the waggons of the goods train in the down loop, caused by ashes from the leading engine of the express train, which ran into them while they were covered with wreckage from the troop train."

The following recommendations are contained in the report:

Construction of coaches should, as far as possible, be of steel, with shock-absorbing buffers.

Any timber or other combustible material used to be rendered non-inflammable.

Special attention should be paid to the construction of doorways, so that doors shall not jam when a collision occurs.

Bars across windows to be easily removable, and windows capable of being opened to their fullest extent.

Provision of electric lighting in all new stock.

Gas lighting in existing stock to be abolished, and electric lighting to be provided as opportunity admits.

"I understand," Lieutenant-Colonel Druitt continues, "that some of the principal companies are carrying out the recommendation as to rendering timber used in carriage construction non-inflammable. Most of the principal companies are providing electric light in all new carriage stock, and some are arranging to convert existing gas-lit stock as opportunity occurs; but this must necessarily be a slow process, spread over many years. All express trains are, I believe, now provided with tools and appliances for extinguishing fires."

METROPOLITAN WATER BOARD.

Twelfth Annual Report—Year ended March 31, 1915.

The Clerk to the Metropolitan Water Board (Mr. A. B. Pilling) sends a copy of the annual report for the twelve months to March 31 last, as approved and adopted at the meeting of the Board on July 23. He also forwards an abstract of the report covering the most generally interesting particulars as to the immense undertaking administered by them.

This points out that the Board came into existence in 1903, under the provisions of the Metropolis Water Act, 1902. The third Board went out of office in June, 1913, when the fourth Board was elected in its place, and will go out of office on June 1 next year. The Board is constituted on the principle of indirect election—namely, of representatives (66 in all) appointed by the County Councils of London, Essex, Herts, Kent, Middlesex, and Surrey, and by the Borough Councils and Urban District Councils comprised within the 559 square miles statutory area of the Board. There are on the fourth Board 17 original members of the Board first appointed in 1903. The County distribution of the Board's statutory area is as follows:

County.	Area, Square Miles.	Acres.
London	116 ..	576
Essex	107 ..	56
Hertford	22 ..	556
Kent	159 ..	82
Middlesex	99 ..	451
Surrey	55 ..	160
Total	558 ..	581

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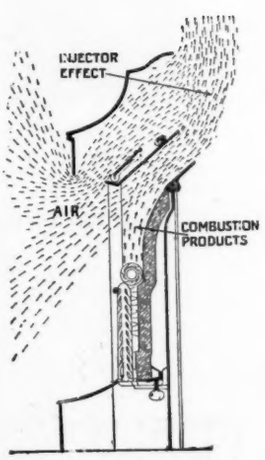
All our 1915 perfectionments are embodied in the entire range of our existing standard patterns—no new designs have to be created to embody these.

We expressly avoid reverting to the discarded system of perforations in the stove-body, where dust may collect.

The ventilating air is drawn from all points of the room.

It is passed through the hottest part of the stove, so avoiding all possibility of high-temperature convection.

There is no admission of air-currents in such a way as to cool down the whole stove-body, on which we count for that proportion of low-temperature convection, the indispensableness of which we have all along emphasised.



JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

The funded debt of the Board at April 1 was:

	Amount of Stock.	Interest.
Metropolitan Water (A) Stock	£6,060,165	£181,805
Metropolitan Water (B) Stock	35,181,889	1,055,456
Redeemable Debenture Stock	7,217,838	216,911
Mortgage Loan	387,000	15,480
	£48,846,892	£1,469,652

In addition to the annual interest shown, there are certain annuities and rent-charges amounting to £7900, or a total of £1,477,552—equivalent to 3 9d. per 1000 gallons supplied.

Water Rental and Deficiency.

The net water rental received by the Board during 1914-15 was approximately £2,933,400 or an increase of £22,690. It is satisfactory to state that, notwithstanding the disturbance caused by the war, the percentage of collection for the half year ended March 31 last, in respect of domestic supplies and fixed charges was 94·4, being the same as for the corresponding period last year.

The effect of the new charges imposed by the Board's Act, 1907, was to create a deficiency (the yield being less than that obtained under the Acts of the old Companies) which had grown to a sum of £359,454 by the end of the year 1914-15. But this deficiency is counterbalanced by the fact that the Board have set aside no less than £545,076 to a new works sinking fund—being bound to do so by law.

The audit of the Board's accounts for the year ended March 31, 1914, showed a certified deficiency of £15,385, as against an estimated deficiency of nearly £105,000. This satisfactory position was attributable to the fact that the income exceeded the estimates by about £70,000 (due to the favourable conditions of the summer of 1913), to a further reduction in allowances for empty premises, and to savings under the head of pumping and distribution charges. Precepts to meet this deficiency were duly issued on the contributory authorities.

The total rateable value of the boroughs and districts in the Board's area directly represented on the Board, and liable to meet precepts for any deficiency that may arise, is as follows:

In London	£45,341,614
In Extra-Metropolitan Counties	11,630,320
	£56,971,934

Staff and Offices.

The Board's staff numbers 923 officers (including 58 women), 3189 workmen and others on weekly wages, and 116 service staff on weekly wages, or a total of 4228 at April 1 last. This represents the normal establishment, after deductiug the temporary workmen engaged to fill the places of men on war leave, whose names accordingly remain on the pay-sheets. The total salary list at the same date was £173,943.

A highly creditable percentage of the Board's officers and servants within military age have joined the Colours; so much so that, in some instances, leave has had to be refused, owing to the exigencies of the Board's service. At the end of August, four members of the Board, with 268 officers and 465 servants, were on military or naval duty. Those killed on active service numbered 23.

Head Offices.

New head offices are in course of erection on a portion of the site in the possession of the Board at New River Head, Rosebery Avenue. The well-known "Oak Room," which formed part of the original "Water House" erected in 1613, will be incorporated in the new structure. Sir Hugh Myddelton's "Round Pond" at New River Head, which had been in almost continuous use for over 300 years, was abandoned in June, 1914, in preparation for part of the site of the new offices.

Sources of Supply.

The Board's supply of water is derived from the Rivers Thames and Lea, the gravel beds near the Thames, the Chadwell Spring (which is the beginning of the New River), and wells sunk in the Lea Valley on the north of the Thames, in Kent, and certain other points south of the Thames. The Board's supply, direct and in bulk to adjacent undertakings) during the year was 89,420 million gallons of water, or a daily average of 245 million gallons. The grand total volume is equivalent to 399·2 million tons of water. The Thames furnished 58·5 per cent. of this total, the Lea 23·1 per cent., and the wells, &c., 18·4 per cent.

The total estimated population supplied by the Board at the close of the year was 6,744,247. It is estimated that 56 per cent. was supplied from the Thames, 24·7 per cent. from the Lea, and 19·3 per cent. from the wells and springs. Of the total population, 65·3 per cent. is north of the Thames, and 34·7 per cent. south of the river. The population inside London is 67 2 per cent. of the whole.

The daily average supply per head was 36·08 gallons, compared with 36·16 gallons in 1913-14.

Storage.

The effective amount of storage and subsidence reservoir capacity for unfiltered water possessed and in use by the Board at the end of the year was as follows:

	Number.	Area in Acres.	Capacity in Million Gallons.
Thames Valley	31	1,026·5	7,267·5
Lea Valley	17	955·0	5,639·5
	48	1981·5	12,907·0

The Board are constructing a reservoir at Littleton, to contain 7000 million gallons—part of an authorized scheme to include a further reservoir to be constructed at Stanwell to contain 3300 million gallons. Considerable variations in the design of the Littleton works have been made, in order to improve the quality of the water and to cope with possible troubles arising from algæ growth. The net effect of the

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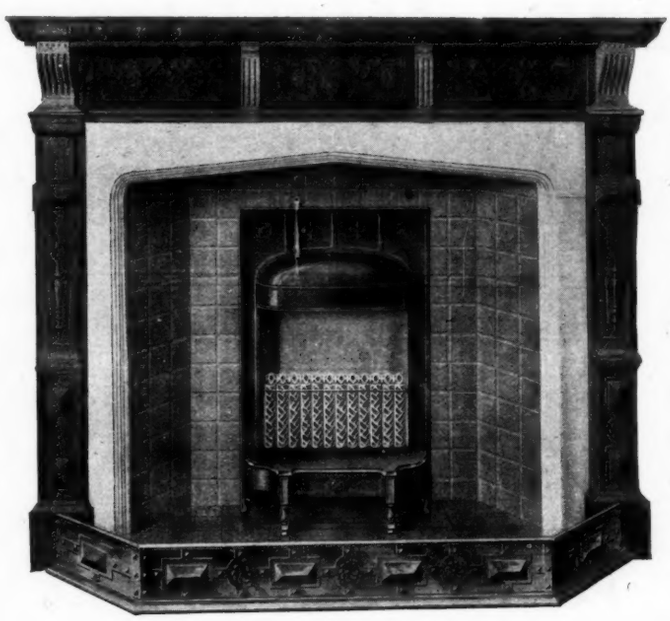

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omissions and additions in the proposed works showed an approximate saving on the contract of £40,150.

The Board have resolved that the supplies from the Littleton and Staines reservoirs should be so arranged as to be drawn upon as equally as possible; the intention being that the storage in the Thames Valley system is to be worked ultimately in a uniform manner, so that the respective periods of storage in all the Thames reservoirs may approximate—due regard being had to periods of drought and the avoidance of double pumping.

Incidental to the construction of the reservoir, it will be necessary to carry out certain works not comprised in the reservoir contract—for example, road widenings, a covered service reservoir, pumping station and plant, conduits, mains, filter beds, &c. The cost of these will amount to a considerable sum, which, however, cannot at present be stated, as the plans are being revised by the Chief Engineer (Mr. J. W. Restler); but it would appear that before water from Littleton can be brought into London, works already authorized by Parliament (including the Littleton reservoir, but excluding the proposed new reservoir at Staines will have to be executed at a cost of at least £3,000,000 on present war prices. It is essential to the maintenance of the supply that these works should be completed within the ensuing five years.

Research Work.

The Director of Water Examination (Dr. Houston) submitted his tenth report on research work during the year, which dealt with seven separate subjects. The report is not only of scientific interest, but of great practical importance.

Comparison of Works.

The following table shows the increases which have taken place under the Board in the active equipment of the water-works since the transfer of the undertakings:—

	June, 1904.	March 31, 1915.
Storage reservoirs for unfiltered water	44	48
Acreage	843	1,981·5
Capacity in million gallons	4,115·7	12,907·0
Service reservoirs for filtered water	75	87
Capacity in million gallons	244·5	312·0
Filter beds	137	172
Acreage	139	170·7
Engines	235	281
Horse power	32,177	43,306
Miles of water pipes	5,759	6,446

Too Much Light at a Gas-Works.—Last Friday, at the local Police Court, Mr. Thomas M. Gledhill was fined £1 for not obscuring lights at the Filey Gas-Works, of which he is Manager.

Increased Cost of Gas-Cookers in Germany.—The Association of German Manufacturers of Gas-Cookers has announced that, owing to prevailing conditions, it found it necessary (in the middle of August) to raise the price of all gas cooking apparatus by 25 per cent.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Before a Lands Valuation Appeal Court for the Burgh of Edinburgh—Lord Provost Inches presiding—the Edinburgh and Leith Gas Commissioners appealed against the assessment of their undertaking within the burgh at £76,932. The figure suggested by the Commissioners was £72,190. They desired that £4896, the amount of income-tax, should be deducted from the revenue of the undertaking for the purpose of assessment. For the Assessor, it was stated that the income-tax was a personal charge. The assessment was based upon the rent, which was already ascertained before the income-tax was paid; and therefore the deduction could not be allowed. The Court were of opinion that income-tax did not form one of the deductions in calculating rent. Therefore they upheld the Assessor, and dismissed the appeal. They were asked to state a case for appeal.

At the Coatbridge Court, the Coatbridge Gas Company appealed against their valuation being returned at £5834, and suggested £4378 as a fair return. On their behalf, it was pointed out that the Assessor wished to alter the system, and assess the Company on the average profits for the past three years. This meant that the Company would require to pay twice over. They had no objection to the three years' basis starting now, but did not want to go back. The Court agreed to assess on the past two years, instead of three; and fixed this year's valuation at £5165 10s.

The "Dundee Advertiser" a few days ago extracted from the recently issued volume of statistics of the London County Council [see *ante*, pp. 385-92] figures relating to the gas and electricity supply of some Scottish towns—showing that in the matter of the price of gas, Dundee compares favourably with most other places. The highest price per 1000 cubic feet at the date of the figures was at Dublin (Company) 39·18d. This appears to have been exceptional, it is remarked, for Swansea (Company) comes next with 33·61d.; Edinburgh is 31·31d.; Aberdeen, 26·26d.; Dundee, 25·51d.; Glasgow, 22·71d. Sheffield (Company) is lowest at 14·89d. In the matter of electricity, Newcastle (Company) is lowest at 0·91d. per unit sold, and Dublin (Municipal) highest at 2·85d. Dundee is 1·25d.; Glasgow, 1·28d.; Aberdeen, 1·38d.; Edinburgh, 1·80d. In the case both of gas and electricity, the supplies in the Scottish cities are provided by the Municipalities concerned.

The Oban and District Gas Company, Limited, have had their yearly valuation for assessment reduced from £300 to £200. The Assessor calculated on the value of the works when acquired for £6500 at 5 per cent. The works have been in existence for twenty years; and it is stated that there is no real rivalry between gas and the electric light. It is anticipated the Gas Company will be ultimately prosperous.

At Coatbridge the Valuation Assessor has desired to alter the usual system, and assess the Gas Company on the average profits for the

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past three years. The Court agreed to assess on the past two years, and fixed this year's valuation at £5165 10s.

The accounts for the Gas Department of the Greenock Corporation for the year ending June 30 show a surplus of £1600. Gas-heaters are said to be more in request this year.

The report of the Turriff Gas Company for the year ended June 24 shows the sum at the credit of profit and loss account to be sufficient for a dividend of 5 per cent (free of income-tax) on the paid-up capital of the Company—leaving to be carried forward, £74. The Directors recommend that the price of gas this year be 6s. 10d. per 1000 cubic feet for lighting, and 6s. 1d. for cookers and motors.

In consequence of the increased price of coal, the Oldmeldrum Town Council have found it necessary to increase the price of gas 1s. per 1000 cubic feet. The advance applies to gas used both for lighting and heating purposes.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 20.

No fresh feature has arisen in the London tar products market. There are some inquiries for pitch; and the makers of the best qualities quote 26s. net per ton f.o.b. makers' works. Creosote remains at 4¼d. net in bulk at makers' works, and solvent naphtha at 2s. 1d. net on the same conditions. The good weather is enabling considerable quantities of pitch and freed tar to be put on the roads.

Sulphate of ammonia is also unchanged at £14 8s. 9d. net per ton, filled into buyers' bags at makers' works for 25 per cent. quality.

Tar Products in the Provinces.

Sept. 20.

There is little or no alteration in the market for tar products. No business of importance is reported in pitch, and prices remain in about the same position. Solvent and heavy naphthas are in good demand. Creosote continues weak.

The average values of gas-works products during the past week were: Gas-works coal tar, 21s. 3d. to 25s. 3d. Pitch, East Coast, 21s. 6d. to 22s. per ton; Norfolk, Suffolk, and Humber ports, 19s. to 20s.; West Coast, 20s. to 21s. Manchester; 21s. to 21s. 6d. Liverpool; 23s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅝d. to 3d. Heavy oils, in bulk, 3⅝d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene, £12 to £20; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Sept.* 18.

There is no change to report either in the tone of the market or in the value of this material, lethargy having prevailed throughout the week. Both producers and purchasers have been inclined to await further developments, and consequently trading has only been on a small scale. The nearest values at the close are still £14 10s. per ton f.o.b. Hull, £14 12s. 6d. f.o.b. Liverpool, and £14 15s. f.o.b. Leith. In the forward position, manufacturers have not made any alteration in their quotations—£14 17s. 6d. per ton for October-December, and £15 for January-June, at the chief ports—without actual business.

Nitrate of Soda.

The market for this article is easier on spot, and prices have declined to 13s. 4½d. per cwt. for ordinary quality, and 14s. 1½d. for refined.

Sulphate of Ammonia.

From another source it is stated that this market is still steady; but not much business of importance has been reported during the past week. Outside London, makes are quoted at £14; Hull, £14 7s. 6d. to £14 10s.; Liverpool, £14 10s. to £14 12s. 6d.; Leith, £14 12s. 6d. to £14 15s.; Middlesbrough, £14 10s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade in the North is still affected by the lack of ready steamers, and the fact that licences for coal export are not very freely granted. This has had most effect on the steam coal trade, so that its prospects are uncertain at present. Best Northumbrian steam coals are quiet at 17s. 9d. to 18s. per ton f.o.b.; second-class steams are 16s. per ton; and steam smalls are dull and plentiful at 11s. 6d. to 14s. 6d. per ton f.o.b., according to the quality. Exports of coals are being freely made to French and Italian ports; but they seem to be more restricted to the North of Europe, and the high freights are a further deterring influence. In the gas coal trade, the demand appears a little better. Best Durham gas coals are about 19s. per ton f.o.b., and there is rather more activity both for home use and for export to the allied countries. Second-class gas coals are unaltered at near 16s. 6d. per ton; and "Wear Specials" are relatively steady at 20s. per ton f.o.b. Steamers are difficult to charter, except at high freights—8s. 3d. to 8s. 6d. Tyne to London for gas coals being quoted, and as high as 19s. 6d. Tyne to Rouen. There is not much doing in new contracts for coal, for the outlook ahead is rather doubtful; and though the deliveries of gas coal are fairly good, yet other kinds of Durham coal are plentiful, and make the markets occasionally easier. In the coke trade, the inquiry is fair. Good gas coke is generally firm at from 28s. 6d. to 30s. per ton f.o.b. in the Tyne.

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Woking District Gas Company.

The Chairman (Mr. C. H. Master, J.P.), in moving the adoption of the report [*ante*, p. 536] at the half-yearly meeting, said that, with the uncertain train and shipping service, and other difficulties, they could imagine what an anxious time their Manager (Mr. W. H. Ely) had gone through. It was an abnormal period; and they had had to raise the price of gas at Woking, as at other places. The Board quite realized that if they could keep the price of gas down [it was now 4s. 6d. per 1000 cubic feet], they would get more trade; but Woking was not a concentrated district. Their mains represented something like forty miles; and taking into consideration this fact, and the population, they would see that it was almost impossible for any company, however well looked after, to furnish gas at what might be called a really low rate. Woking was increasing, and their business was growing; so that there was need for further producing plant. Accordingly the Directors had committed themselves to an outlay of some £4000; and more capital would have to be raised. The report having been adopted, and the dividends recommended declared, the Directors, Secretary (Mr. B. Dennett Holroyd), Manager, and staff were thanked for their successful working during a very difficult time. Thereafter a special meeting was held, at which the Board were authorized to issue a certain amount of new capital, as needed.

Keighley and War Expenditure.

Inasmuch as there are very few public works of any kind now in hand at Keighley which are not essential to keep the industries of the town going—and many of these industries being engaged on Government orders—it is not anticipated that these works will be affected to any marked extent by difficulties with the Government Departments over the question of expenditure in war time. The Town Council recently entered into contracts for extensions to the existing electricity plant involving an outlay of close upon £20,000. They were threatened with a stoppage of the work by the Local Government Board until explanations had been entered into to show that, unless the extension were proceeded with, the Corporation could not meet the demand for current for power purposes, and the slightest accident might very easily lead to a stoppage in the local factories and workshops dependent on electrical power, and consequent delay in delivering Government orders. Having regard to these considerations, the Board eventually agreed to the whole of the proposed improvements and extensions being proceeded with. The Council had to go through much the same process in respect of the installation of new plant at the gas-works. At one point they were threatened with considerable delay owing to the withdrawal of men for direct Government employment; and representations had to be made as to the importance of completing the contracts with all reasonable speed, in order to obviate interference with the local industries through a gas-works breakdown. The only other undertaking of any size the Corporation have in hand is the new Sladen Valley water-works; and this work is as essential to the industrial well-being of the town as the other two extensions. The work has not advanced very far, having been in progress only a year or two; and, even under the most favourable conditions, it would probably take another four years to complete. Long before this time, there is grave danger of Keighley suffering from a shortage of water.

Electricity and Gas at Hove.

A proposed increase of 20 per cent. in the charge for current by the Hove municipal electricity undertaking, has led to the following pertinent remarks by the "Sussex Daily News," which says that tradesmen are not inclined to accept the increased tariff with complacency: "One feature of the situation has raised an important question. How is it the decline in the sales of electricity became so alarming in the quarter of the year of the war when the days are longest, the nights shortest, and therefore the lighting restrictions were the least operative? It was not until the March to June quarter that the discrepancy was sufficiently noticeable to require an alteration in the charges. The quantity of units taken for the lighting of public streets in Hove is, under the most favourable conditions, a mere bagatelle. Nearly all the public lamps are supplied with gas. The electricity consumed in shops or business establishments during the March to June quarter would be the smallest of the entire year. Yet in this period the consumption fell off 26,397 units, representing a loss of £780. Concurrent with this decrease of business in electric lighting in Hove, the Brighton and Hove Gas Company report one of the largest increases in gas sales ever recorded in the district. There is a widespread impression in Hove that there must be some significance in this extraordinary contrast in the experiences of two undertakings carrying on a similar line of business. The force of the comparison is enhanced when due allowance is made for the fact that the Gas Company's loss on account of street lighting restrictions in Hove was £1800. No doubt the Gas Company's loss on account of street lighting was set off by the increased use of gas for cooking and heating; but it is not forgotten that the electrical experts have been straining all their resources for years to popularize electrical cooking and heating appliances. Without some fuller explanation, there would seem to be no logical reason why the lighting restrictions in themselves should produce such a difference in their effect upon the two systems of lighting. The causes are probably slow to reveal themselves. It is rumoured that many consumers of electricity, in view of the announcement that, in cases of emergency, the whole current will be cut off at a moment's notice, are preparing to rely in future upon the gas service."

Coal Shortage in Sweden.—There is said to be great anxiety in Sweden because of the non-delivery of coal from England. The gas-works are especially hard pressed; and many private factories are in a desperate position. From Sept. 1, 250,000 tons of coal were expected each week; but instead of this, the restriction on the exports has been such that supplies from England have practically stopped.

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Bexhill Water and Gas Company.

The Directors report that the accounts for the half year ended June 30 show a balance at credit of profit and loss account available for dividend of £8013. They recommend that a dividend be declared for the six months at the rate of 6½ per cent. per annum on the £34,000 authorized by the Acts of 1885 and 1892, and at the rate of £4 11s. per cent. per annum on the £123,710 authorized by the Act of 1896, Order of 1901, and Act of 1904, less income-tax. This, with provision for income-tax, will absorb £3919, leaving £4094 to be carried forward. The revenue amounted to £13,507, as compared with £12,732 in the same period of 1914, being an increase of 6 per cent. The high prices of fuel and stores consequent on the war, and also the scarcity and cost of labour, have caused the Directors considerable anxiety. Gas coal, while far more costly, and at times difficult to obtain, has been of mixed quality, yielding less gas and less coke per ton carbonized; while special expenses on watching and guarding the works have still further raised the expenditure. These exceptional charges have hitherto been in a large measure met by the increased business of the Company, as well as by the efficiency of the new retort-house; and it is gratifying to the Directors that the working of the Company under so many adverse circumstances enables them to recommend the same dividend as last year. In view, however, of the conditions mentioned, and the great uncertainty as to the duration of the war, they have decided to increase the price of gas 3d. per 1000 cubic feet as from the next Michaelmas readings.

Stretford Gas Company.

The report presented at the 125th half-yearly meeting of the Company stated that the profit for the six months ended June 30 was £5880; and adding to this the balance of £2420 brought forward, made the amount disposable £8300. The Board deemed it necessary and prudent to further write-down the investments of the Company to their value as on June 30; and they had therefore applied £738 to this purpose, thus reducing the disposable sum to £7562. The Directors recommended dividends at the rate of 10 per cent. per annum on £25,000 and 7½ per cent. per annum on £14,000 original £5 shares, 7 per cent. per annum on £61,000 new "A" £10 shares, and 5 per cent. per annum on £40,000 new "B" £10 shares. These would absorb £4910, leaving £2652 to be carried to the next account. Fifty-two of the Company's staff have gone on active service; and following the example of corporations and other public bodies, the Company are treating their dependants liberally. The loss of these employees has somewhat inconvenienced the Company; but the remaining members of the staff have shown a most praiseworthy desire to meet the difficulties of the position. The Chairman (Mr. W. A. Nicholls) said that the main points they had to consider were the troublesome times the country was experiencing, the high price of coal, and the lower prices of residuals than they anticipated. The only residual that would give a favourable return would be coke, the price of which would be dependent upon the price of coal. The Coal Prices (Limitation) Act would not affect the Company's finances except to a very slight extent. As to labour, they might have trouble in getting sufficient men to deal with the coal during the winter. They had in their employment sufficient for gas manufacturing purposes. The outside work, however, could only be carried on under great difficulties, as the staff was less than half what it was twelve months ago. In order to encourage men to come to them, they advanced the wages last February to the extent of about 7½ per cent. In addition, they had since given a bonus of 5 per cent.; and they were putting another bonus of 5 per cent. aside, which would be paid to every man in their employment next Easter. They were recognized as a munitions works; and their men of military age were wearing a Government badge. The outlook for the next twelve months was anything but rosy. The estimated expenditure would be £13,000 up; and it was doubtful if they would be able to pay the dividends without absorbing the undivided profits now in hand. It was stated during the meeting that the increase of 4d. per 1000 cubic feet in the price of gas in Stretford compares favourably with the increases made by some neighbouring companies.

Unauthorized Extinction of Street-Lamps.—The following officia notice points to the need for damping the ardour of amateur "lamp extinguishers" in London: "The Commissioner of the Metropolitan Police desires to draw attention to the fact that any person unlawfully extinguishing a street-lamp in the Metropolitan Police district commits an offence, and is liable to summary arrest. The present reduction of street lighting has been effected in accordance with a considered scheme; and if unauthorized persons take it on themselves to extinguish street-lamps, great confusion and danger may be created.

A Comparison of Gas and Electricity.—In connection with suggested activity on the part of the Electrical Distribution Company of Yorkshire, Mr. J. H. Brearley, Consulting Engineer to the Penistone Gas Company, attended a meeting of the Urban District Council, and suggested that if electricity was to be introduced the best course would be for the Council to apply for an Order. Comparing gas and electricity, he said that the latter at 4d. to 4½d. per unit for lighting was twice as costly as gas; while at nine-tenths of a penny for power it had no advantage over gas. In his own district, electric motors had been taken out and replaced by gas. He further argued that competition would not tend to reduce the price of gas.

Street Lighting at Hackney.—The Hackney Borough Council have been recommended to exercise the option given to them under the arrangement made with the Gas Light and Coke Company in 1910, when inverted incandescent burners were substituted for uprights in the street-lamps, whereby such arrangement is to continue for a further period of five years, with a reduction of price at the rate of 5 per cent. from the charges at present being paid—viz., £2 3s. 6d. per lamp per annum for the gas, lighting, repair, and maintenance of each lamp fitted with one burner, £3 8s. 6d. per lamp per annum for each lamp fitted with two burners, and £4 13s. 6d. per lamp per annum for each lamp fitted with three burners. These prices to be irrespective of any variations in the price of gas during the contract period.

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Price Raised at Malton.—The Malton Gas Company have advanced their charge for gas 3d. per 1000 cubic feet; a corresponding increase being arranged in regard to consumption through prepayment meters. The new price will come into force about the 1st prox.

Street Lighting at Harlow.—The lighting question was considered at the last meeting of the Harlow Parish Council, when the Lighting Committee reported that they had resolved to recommend the Council not to accept the tender of the Gas Company for the lighting of the public street-lamps, owing to the restrictions of the Lighting Order. The Chairman of the Lighting Committee (Mr. Baker) reminded the Council that at a previous meeting it was suggested that they should light only a certain number of lamps at dangerous corners. A letter from the Gas Company had been received which gave several alternative prices.

Primitiva Gas Company of Buenos Ayres.—The accounts from Buenos Ayres for the half year ended June 30 have been received; but the Board regret that they do not permit the declaration of any interim dividend on the ordinary shares for this period. The action of the British Government in practically prohibiting the export of gas coal has prevented the shipping of coals for which they had contracted, and has compelled them to purchase in the United States at very high prices. The falling off in the profits is more than accounted for by the consequent high cost of coals and freights, which show an increase of no less than 14s. 10d. per ton over the corresponding period of last year. The Company appealed to the Municipality of Buenos Ayres for permission temporarily to increase the selling price of gas, in order to meet this abnormal state of things, but without success. Although there are indications of returning prosperity in Argentina, these have not yet matured in the City of Buenos Ayres; and the Company have had a further falling off in the consumption of gas for the half year under review.

Further Increase in Price at Stalybridge.—The Stalybridge Town Council have unanimously approved minutes of the Gas Committee recommending that the price of gas be increased 3d. per 1000 cubic feet as from the 25th inst. It was pointed out that when the Committee budgeted in March for the price of gas, they fixed it at 2s. 9d., but with a promise that there should be a revision in September. Coal is now costing more than had been anticipated; and residuals are selling at considerably less. This and other considerations make the present recommendation necessary.

Stoppage of New Water-Works at Bradford.—In regard to the suspension of operations, by instruction of the Local Government Board, upon the duplicating of the Bradford water-main from the Nidd Valley to the city [*ante*, p. 603], it is felt in the city that the danger of a shortage next year is so serious that further efforts must be made to get the sanction of the Board to proceed with the scheme, in connection with which a good deal of work has already been done. The Water Committee have expressed regret that the Board had adopted such an attitude in regard to the scheme; and a deputation has been appointed to wait upon the Board and the Treasury to urge that the work be allowed to proceed.

APPLICATIONS FOR LETTERS PATENT.

12,740.—Drössel, F. A., "Burners." Sept. 6.
12,756.—Curry, M., and Wood, N. O., "Fire-bricks." Sept. 6.
12,776.—Bird, H., Cort, R., and Son, Limited, "Charging retorts." Sept. 7.
12,878.—Anderson, J., "Gas-meters." Sept. 8.
12,968.—Bentley, J. E., "Gas-regulators." Sept. 10.
13,025-6.—Anderson, J., "Gas-meters." Sept. 11.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business on the Stock Exchange was again at very low pressure last week. Daily it became quieter and quieter, reaching its *nadir* on Saturday—the great Jewish Fast day, when the House might to all intents and purposes as well have been closed. The general tendency was towards easier prices—a not unnatural recoil from the free advances recently scored. But additional factors tending to shake firmness were the regrettable manifestations of sharp differences of opinion in Governmental quarters upon matters of supreme importance, and the ceaseless insurgency of labour difficulties. Thus the War Loan and kindred securities were a falling market. Stronger points were in Americans and Canadians; the harvest reports in the Dominion continuing to be highly satisfactory. South Africans were firm. Armaments and munitions were still in demand; but a set-back was apparent in shipping undertakings. A good deal of feeling on the part of the latter has been aroused by the directors of one of them proposing to take powers to reject a transfer of shares to any person not approved by them. If such powers were exercised capriciously or dishonestly, it would be intolerable; but it is conceivable that such powers in some circumstances are to be desired. For example, if the directors got wind of a plot to secure a controlling interest in the concern in the hands of alien enemies, how else could they defeat it? It is all a question of confidence in an honest board. Business in the Gas Market was a little bigger than the week before—it did not require a microscope to see it. But there was not enough to afford any indication of a tide in prices either way. In the Money Market conditions of marked ease prevailed.

Bargains done for cash during the week were as follows: On Monday, Bombay 5, 5$\frac{3}{16}$, Gas Light ordinary 78$\frac{1}{2}$, 79, 79$\frac{1}{4}$, Primitiva 2$\frac{15}{32}$, ditto preference 3$\frac{5}{8}$, South Metropolitan 80$\frac{1}{2}$, ditto debenture 60. On Tuesday, Commercial 4 per cent. 84$\frac{3}{4}$, 85, ditto 3$\frac{1}{2}$ per cent. 81, 81$\frac{1}{4}$, Gas Light ordinary 78$\frac{1}{4}$, Liverpool 96, Primitiva 2$\frac{3}{8}$, ditto preference 3$\frac{3}{8}$. On Wednesday, Gas Light ordinary 78$\frac{1}{2}$, 78$\frac{3}{4}$, 79, ditto debenture 62$\frac{1}{2}$, Melbourne 96$\frac{3}{4}$, South Metropolitan 80, ditto debenture 60$\frac{3}{4}$, 61. On Thursday, Gas Light debenture 62$\frac{1}{2}$, South Metropolitan 79$\frac{1}{2}$, 80, ditto debenture 60$\frac{1}{2}$, 61. On Friday, Brighton and Hove debenture 87, 87$\frac{1}{4}$, South Metropolitan 77, 78$\frac{3}{4}$, 79$\frac{1}{2}$, 80. On Saturday, Brighton and Hove ordinary 127$\frac{1}{2}$, 128.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING SEPT. 18.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5⅛—5⅜	5 17 8	5—5 3/16
50,000	10	Feb. 26	16	Bournemouth Gas and Water { B 7 p.c.	22—30	5 6 8	..
878,480	10	,,	7	Pref. 6 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	Deb.	13½—14	4 5 9	..
—	—	—	—		..	—	..
880,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	11	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,350	,,	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,880	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,300	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	127½—128*
630,000	20	Mar. 26	12½	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	84½—85
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	5 1 6	81—81½
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,009,180	10	July 29	10	European, Ltd.	17½—18	5 11 1	..
16,369,910	Stk.	Feb. 12	1/17/4	Gas Lights and Coke { 4 p.c. Ord.	98—102	4 15 6	78½—79½
2,600,000	,,	,,	3½	3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	4 p.c. Con. Pref.	96—99	4 0 10	..
4,674,850	,,	June 11	3	3 p.c. Con. Deb.	72½—74½	4 0 6	62½
180,000	,,	,,	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½†	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6½†	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,942	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. { A	211—213	4 13 11	96*
718,100	,,	,,	7	{ B	146—14	4 14 7	
305,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
75,000	5	June 11	6	Malta & Mediterranean	4¼—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	4 9 1	96½
541,930	20	May 28	4	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd.	7¼—7⅜	6 9 0	..
60,000	50	Feb. 26	18	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	Do. C	118—121	4 19 2	..
52,000	50	,,	10	Do. D	..	—	..
249,980	5	April 29	8	Primitiva Ord.	5⅛—6	6 18 4	2 3/32—2 15/32
499,960	5	June 26	5	,, 5 p.c. Pref.	4¾—5	5 0 0	2 3/32—3 1/32
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	{ 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	233—234	4 9 8	..
309,984	,,	,,	10	Do. B	232—234	4 9 8	..
523,500	,,	,,	10	Do. C	230—232	4 10 1	..
90,000	10	May 28	9	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	South Met., 4 p.c. Ord.	111—113	4 16 8	77—80½
1,895,445	,,	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60—61
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 6	..
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
127,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham District { A 5 p.c.	185—188	5 8 8	..
742,275	,,	,,	6†	B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
30,000	Stk.	Feb. 26	8⅝	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅜	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6½	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6½	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

* Ex Div.

Reported Scarcity of Petroleum and Coal Gas in Germany.—The Amsterdam correspondent of the Central News learns that petroleum and coal gas are so scarce in Germany that the people have been advised by the authorities to use alcohol in various forms for illumination purposes—there being a sufficient quantity for the purpose.

History of Gas Lighting in Bradford.—Last week saw the ninety-second anniversary of the first use of gas in Bradford. It is recalled that the occasion was the outcome of very long and careful thought and consultation with Counsel; it being eventually decided by the Commissioners of the town to contract for gas lighting instead of oil, provided the cost amounted to not more than the average of the preceding three years with oil lighting. The Bradford Gaslight Company was then formed, with a capital of £15,000, in £25 shares, who offered to light the town for £210 per year. The Company were later taken over by the Bradford Corporation for £210,000.

Less Stringent Lighting Regulations at Manchester.—The regulations concerning the lighting of Manchester thoroughfares have again been under the consideration of the City Gas Committee, with the result that arrangements are being made for improved lighting during the winter months. The department has been in communication with the Home Office, and permission has been given for a better diffusion of the light from public lamps. It is understood that there will not be any great addition to the present number of lights; but the shading of the lamps will be considerably reduced, particularly at busy corners and crossings, where, under the regulations hitherto enforced, many pedestrians have felt there was always an element of danger.

Knowle and District Gas Company, Limited.—The result of the Company's trading for the year ended June 30 (after paying debenture interest and providing for depreciation) is £790, making, together with £192 brought forward, £985. The Directors in their report state that they have added £200 to the reserve fund; and they recommend a a dividend of 10 per cent., less income-tax, on the paid-up capital. The balance carried forward will be £298. The working statement of Mr. F. J. Ward (the Manager and Secretary) shows that the total output of gas was 13,833,000 cubic feet; the make per ton of coal carbonized being 13,715 cubic feet, and the sale per ton 12,823 feet. The amount of unaccounted-for gas was 4·24 per cent. on the make. There are 422 consumers, and close upon 10 miles of mains.

Newcastle (N.S.W.) Gas Company.—At the 98th half-yearly meeting of the Company, Mr. J. R. Hall (the Chairman) said the profit for the past six months was £277 more than for the corresponding period of last year. It would have been possible to have paid the same rate of dividend as formerly, by encroaching on the balance brought forward; but the Directors thought it more prudent, at a time like the present, to strengthen rather than weaken the reserves. The dividend recommended was 7 cent. on the "A" and "B" shares, and proportionately on the "C" shares. This compared favourably with the rate paid by other gas undertakings similarly circumstanced, notwithstanding that the Company charged 4d. per 1000 cubic feet less than any other Company in Australia. The Directors had thought of applying to the Minister for permission to increase the selling price; but after consideration they decided the present was not an opportune time.

Warning to Gas Consumers.—The Chairman of the Gas Committee (Mr. J. Stott), addressing the members of the Hindley Urban District Council at last week's meeting, said it was essential that gas consumers should know the difficulties which the gas management were labouring under at the present juncture. Shortage of labour was playing havoc with them, and what was going to be done he really did not know. He wished to give warning to consumers to be as careful in their consumption of gas as they possibly could. The Manager (Mr. H. O. Timmins) and his staff were doing all they possibly knew how to do. It was rather awkward to have to mention the difficulties; but if they were only appreciated, there would not be so many complaints coming to the office, and people would bear with them and accept their excuses as reasonable. In the event of a shortage—he did not say there would be one—it would be unreasonable to let the people be in a dilemma without being prepared, and having made some provision. He made these remarks in order that consumers might economize, and that some reasonable excuse might be made for the management and the staff.

Southport Water Board.—At the last meeting of the Southport, Birkdale, and West Lancashire Water Board, the Clerk (Mr. Alleyne Brown) read a draft copy of an application to be made to the Local Government Board for a Provisional Order to alter the constitution of the Board by providing for the representation of the Formby Urban District Council, and the amount of the contribution to be paid by the Formby Council in respect of any deficiency in the net revenue. An arrangement was made in 1905 for the express benefit of the Formby Urban District Council, by which they were not to contribute until Sept. 30, 1915. As far as representation was concerned, the Water Board submitted that, as the Southport Corporation now had ten members on the Board, and the West Lancashire Rural Council had two members, it was a fair and reasonable proposition to allocate three members from the Formby Urban District Council. The draft also stated that the provision that the representation of Southport on the Board should exceed by not more than one member the combined representation of the other Councils, had had no bearing on this question since the union of Southport and Birkdale in 1911. The basis of contribution had in the past been the rateable value; and it was submitted that no better basis could be suggested. They therefore applied to the Local Government Board to alter the constitution so as to provide that it should consist of fifteen members, ten to be appointed by the Southport Corporation, two by the West Lancashire Rural District Council, and three by the Formby Urban District Council. The Board had approved the draft of the application. The proposal is an important one, as it means, if approved, that Formby will contribute a portion to any future precept of the Water Board. In his annual report last May—setting forth the estimate of rates for the current year—the Southport Borough Treasurer (Mr. George Lloyd) said that the Water Board precept last year was £11,232. The estimate as advised for this year is £12,980—an increase of £1748, equivalent to a rate of ¾d. in the pound. The Corporation levied a rate of 6d. in the pound to meet it.

Damage estimated to amount to £10,000 resulted from a fire last week at the Victoria Saw Mills, Sheffield. The cause of the outbreak is stated to have been a gas explosion in the mills.

The will has been proved of Colonel Thomson Wilson, J.P., a Director of the Beccles Water-Works Company, and Alderman and six times Mayor of the town. He left property of the gross value of £15,789.

The death is announced, at Atherstone, of James Thomas, the tallest man in Warwickshire, who stood 6 ft. 6 in. high. He was a lamplighter; and his stature enabled him in many places to dispense with the usual pole.

At a meeting of the York City Council last week, a member moved an amendment to the minutes to the effect that a war bonus of 2s. per week be granted to Corporation employees, maintaining that the extra cost of £1900 would be saved by the reduction in the cost of street lighting, under the present restrictions. The amendment was defeated by a large majority.

The Special Correspondent of the "Daily Telegraph," cabling from Mitylene, says news from Constantinople states that cargoes of 9000 tons of coal, which succeeded in eluding the Allied Fleet, have reached Constantinople. This has relieved, for a time, the unbearable conditions which were created through the shutting-down, for want of fuel, of the gas-works and all the flour mills. The closing of these works threw the streets of the capital into darkness at night and caused a bread famine.

The Deptford Borough Council have been recommended to have the street lighting reduced by one half, and to approach the South Metropolitan Gas Company with a view to a reduction of charges during the period this arrangement is in operation. The Police authorities originally urged a further diminution of street lighting, and suggested the blackening of the lamp-glasses. The Borough Council Works Committee were, however, of the opinion that the case would be met by the adoption of the above recommendation, which would also meet the Local Government Board's suggestion on the subject of economy in expenditure.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

MANAGER. No. 6095.
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Meeting.

BRITISH GASLIGHT COMPANY. 11, George Yard, Lombard Street, E.C. Sept. 29. Twelve o'clock.

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Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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